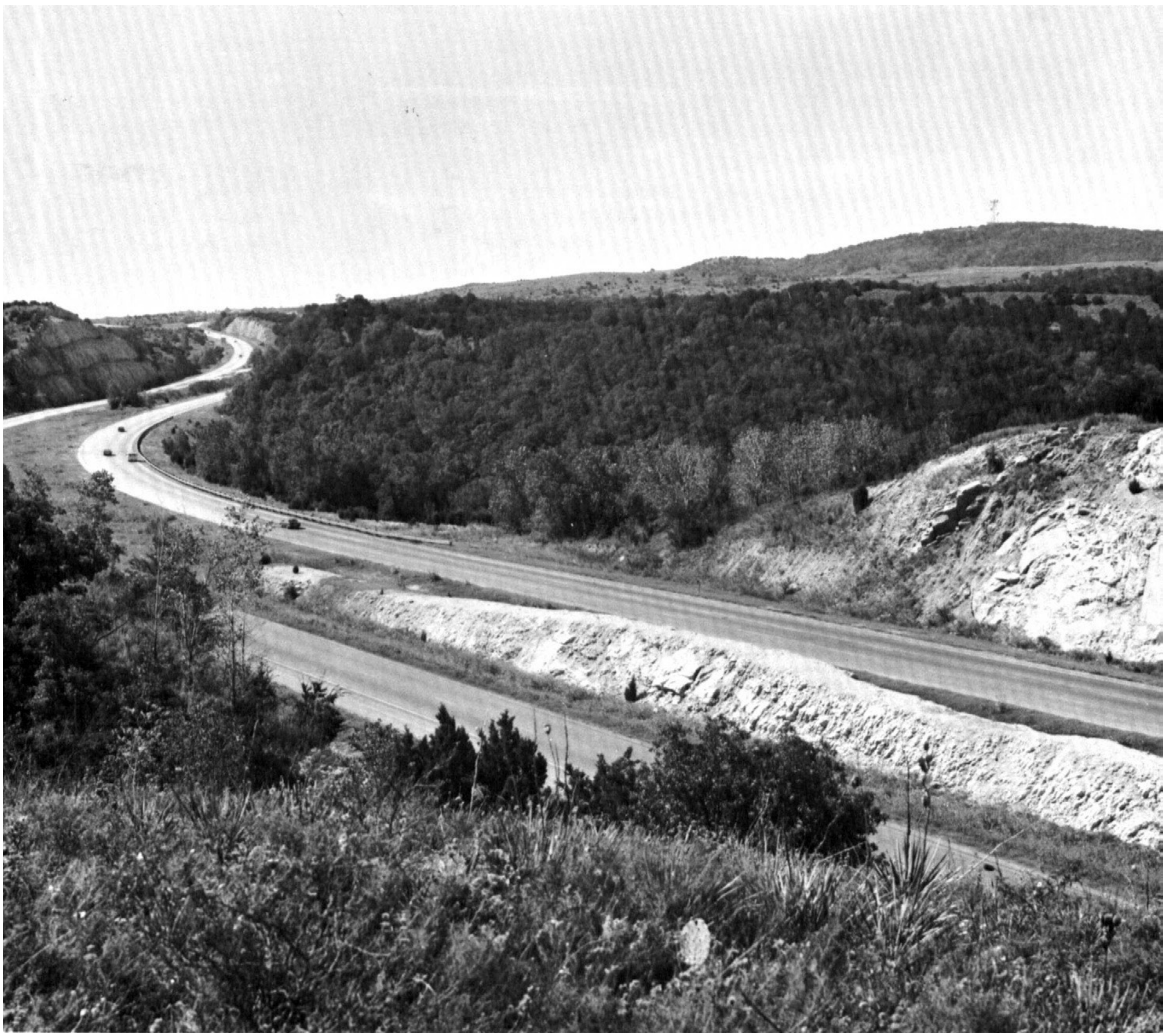
United States Department of Agriculture

Soil Conservation Service

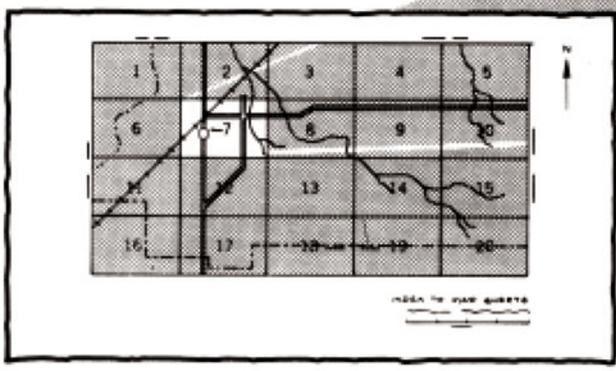
In cooperation with the Oklahoma Agricultural Experiment Station

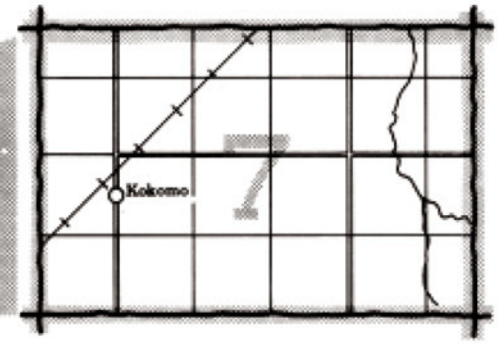
Soil Survey of Murray County, Oklahoma



HOW TO USE

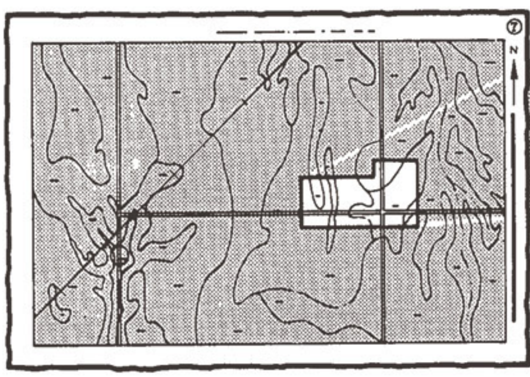
1. Locate your area of interest on the "Index to Map Sheets"

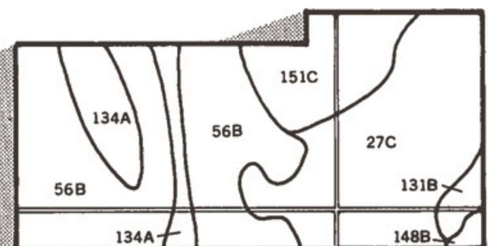




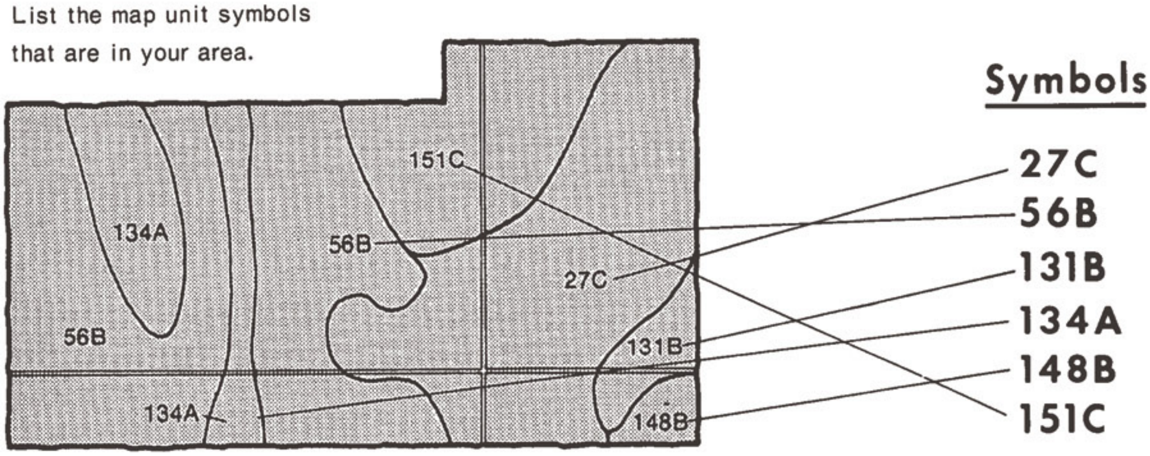
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



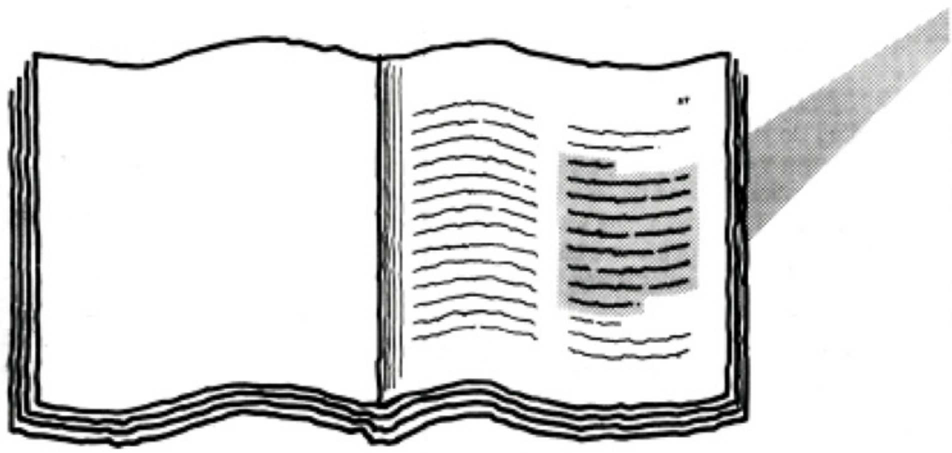


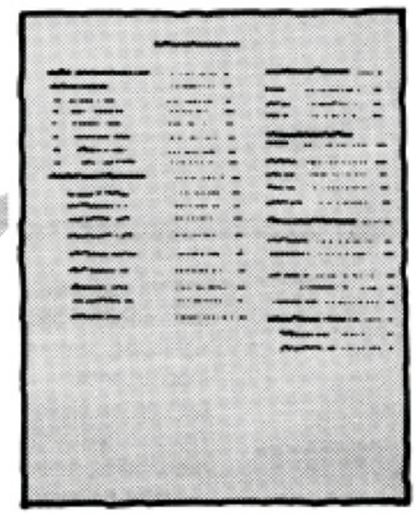
4. List the map unit symbols that are in your area.



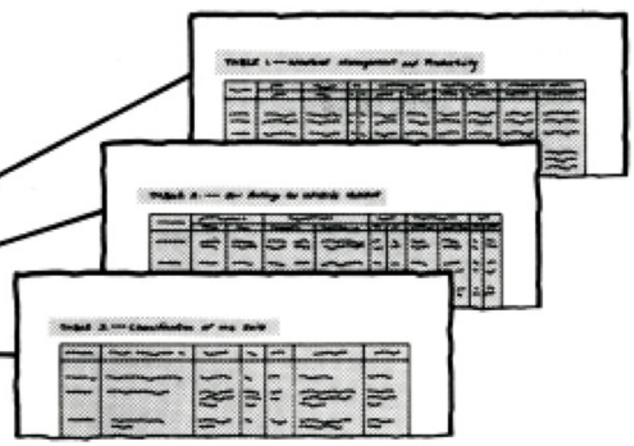
THIS SOIL SURVEY

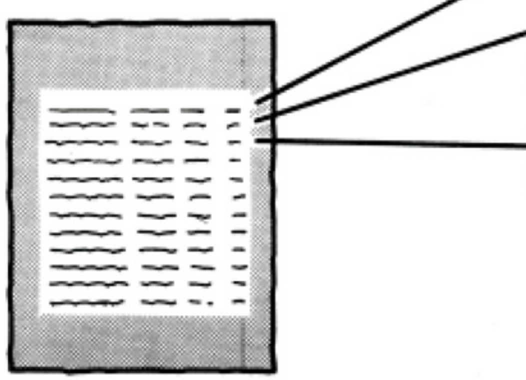
5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.





6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.





7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in 1980. Soil names and descriptions were approved in 1980. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1980. This survey was made cooperatively by the Soil Conservation Service and the Oklahoma Agricultural Experiment Station. It is part of the technical assistance furnished to the Murray County Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: An area of the Arbuckle Mountains. Kiti soils are on the mountains in the foreground, and Timhill soils are on the high ridge in the extreme background.

Contents

Soil Series

Issued November 1984

Index to Map Units

Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Murray County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

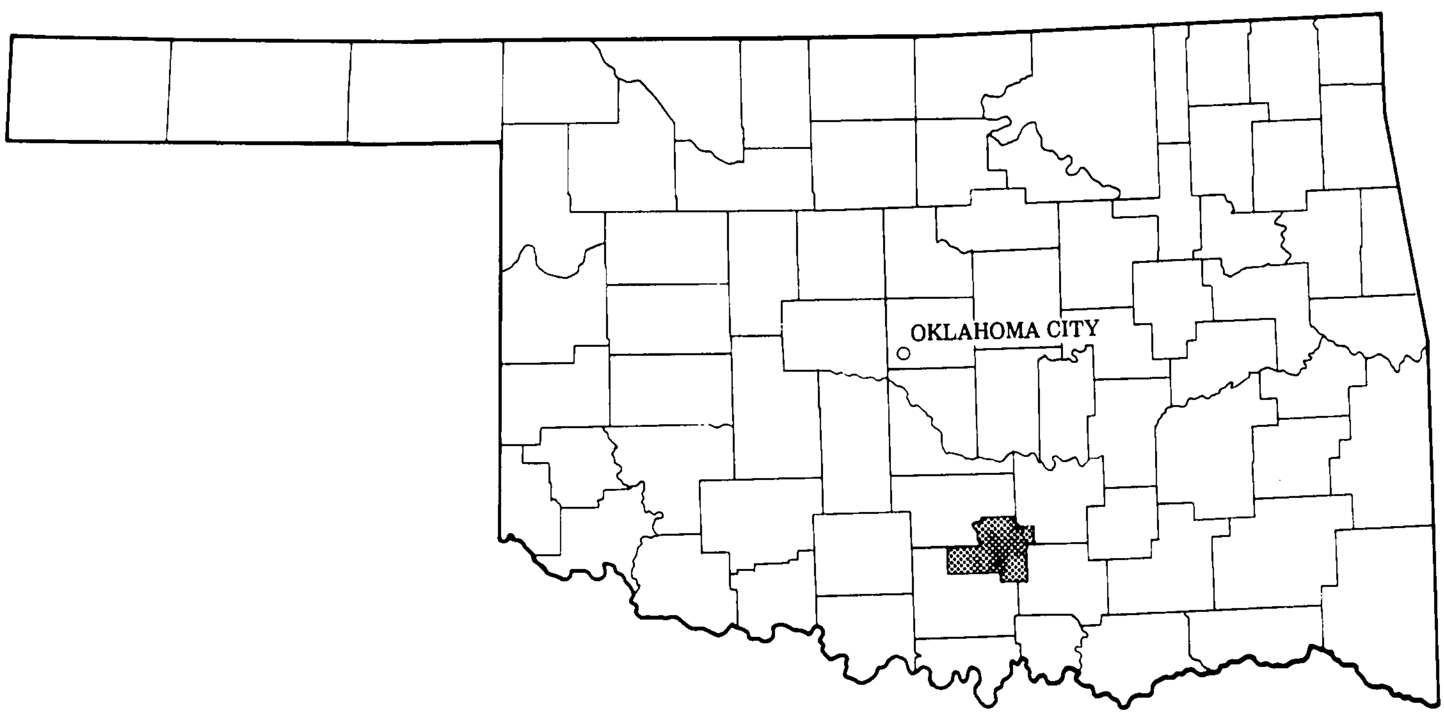
This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Roland E. Willis

Roland E. Willis
State Conservationist
Soil Conservation Service



Location of Murray County in Oklahoma.

Soil Survey of
Murray County, Oklahoma

By Anderson Watterson, Jr., Vinson A. Boggard, and
Gordon E. Moebius, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service
In cooperation with the Oklahoma Agricultural Experiment Station

MURRAY COUNTY is in the south-central part of Oklahoma. It has an area of 273,920 acres, or 428 square miles. The part of Arbuckle Lake in the county and other areas of water over 40 acres make up 3,570 acres of the total acreage. The county is bordered on the north by Garvin and Pontotoc Counties, on the east by Johnston and Pontotoc Counties, on the south by Carter and Johnston Counties, and on the west by Carter and Garvin Counties.

This survey replaces an earlier survey of Murray County published in 1939 (*3*). It updates the earlier survey by providing more detailed information and current interpretations for land-use planning.

In 1980, Murray County had a population of 12,021. Sulphur, the county seat, is the largest city in the county. In 1980, Sulphur had a population of about 5,400. Other incorporated towns are Davis and Dougherty. Some of the other communities in the county are Joy, Scullin, Hickory, Drake, Nebo, Buckhorn, and part of Hennepin.

Murray County is largely rural. Raising beef cattle and sheep are the chief enterprises. Oil, gas, egg and milk production, and manufacturing also contribute to the economy. The principal farm crops are winter wheat and oats, alfalfa, grain sorghum, and soybeans. Most of the crops are grown along the Washita River and Chigley Sandy Creek and on very gently sloping to gently sloping uplands in the northern part of the county.

General Nature of the County

This section gives general information concerning the county. It discusses physiography, settlement and development, natural resources, transportation and industry, and climate.

Physiography

Murray County is in the Grand Prairie and Cross Timbers major land resource areas. The Washita River borders part of the northwestern area of the county, and it crosses through the county at Davis, from northwest to slightly southeast. The area west of the Washita River consists of very gently sloping to steep, rocky uplands that are cut by numerous valleys and small tributaries. The northern, southern, and eastern parts of the county consist of smooth, very gently sloping to steep uplands. Flood plains are along the Washita River and Guy Sandy, Chigley Sandy, Rock, and Mill Creeks.

The general slope is toward the south and east. Elevation ranges from 750 feet, where the Washita River leaves the county, to 1,450 feet, in the timbered hills in the western part of the county.

Settlement and Development

The Choctaw Indians were the first permanent settlers in Murray County. The Chickasaw Indians later settled the area, in about 1840. Murray County is in the heart of the Chickasaw Nation.

The Chickasaw Indians brought ponies to the area, and they established grist and lumber mills, gins, and stores. They operated ferries, toll bridges, and pack trains and traded with the western tribes.

The Chickasaw and Choctaw government was terminated on March 4, 1906. Members of these tribes became U. S. citizens, and new territorial boundaries were established in Oklahoma.

Between 1910 and 1930, many acres of land were cleared for farming, and the number of domestic cattle increased. The farmland was planted to cotton, corn, and wheat. The depression and the "dust bowl" conditions of the 1930's, however, forced many farmers to abandon their land. Much of the land was sold to the larger cattle ranches or taken over by the banks that held mortgages. The fields lay idle for many years, and many of the soils of the uplands became severely eroded.

The people of Murray County, like those in other counties across the state and nation, began to restore the land. Under the direction of the Soil Conservation Service, through local conservation districts, residents started shaping gullies, planting bermudagrass, and building terraces and ponds in the early 1940's. Due to these and other erosion control measures and maintenance practices, the county now has a prosperous agricultural industry.

Ranching is the main enterprise in the county. Most of the rural income is derived from beef cattle and sheep, but dairy cattle and egg production also contribute to the rural family income.

About 95 percent of Murray County has some type of conservation plan. Over 650 landowners and operators cooperate with the Murray County Conservation District.

Natural Resources

Productive soils and available water, sand, gravel, limestone rock, and oil are the most important natural resources in the county. A large acreage of soils in the county is productive and has high potential for native grasses and introduced grasses, such as bermudagrass, weeping lovegrass, and plains bluestem, and for crops, such as wheat, oats, grain sorghum, and soybeans. Rangeland makes up over half the area of the county. Although much of the rangeland and cropland was damaged by erosion and overgrazing in the past, proper management can increase production of native grass and crops.

The county has numerous underground springs. Most have flowed even in the worst droughts and have provided an ample water supply for livestock and other uses. There are two lakes, Lake of the Arbuckles and Veterans Lake, used for recreation and domestic water supply. The Washita River is another source of water in the county.

Numerous oil wells and several large limestone quarries are located in the Arbuckle Mountain area of the county.

Transportation and Industry

Murray County is served by a network of state and federal highways. Federal Highways 77 and 177 and Interstate 35 cross the county in a north-south direction. State Highway 7 crosses the county in an east-west direction. In farm areas, dirt, gravel, and paved roads provide access to state and federal highways. Railroads transect the county in a north-south direction.

Industry in the county includes rock crushers, trucking firms, concrete plants, manufacturers of oil equipment, and a livestock market. These industries are in or near Sulphur and Davis.

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Pauls Valley in the period 1951 to 1977. Although Pauls Valley is in Garvin County, directly to the north of Murray County, the climatic conditions there are similar enough to be representative of the conditions in Murray County. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 43 degrees F, and the average daily minimum temperature is 30 degrees. The lowest temperature on record, which occurred on January 10, 1977, is -10 degrees. In summer the average temperature is 82 degrees, and the average daily maximum temperature is 95 degrees. The highest recorded temperature, which occurred on August 6, 1956, is 112 degrees.

Growing degree days are shown in table 3. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 38 inches. Of this, 20 inches, or 60 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 15 inches. The heaviest 1-day rainfall during the period of record was 11.61 inches on October 8, 1970. Thunderstorms occur on about 50 days each year, and most occur in spring.

The average seasonal snowfall is 8 inches. The greatest snow depth at any one time during the period of record was 9 inches. On an average of 3 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 75 percent of the time possible in summer and 60 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 15 miles per hour, in spring.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another resulting in gradual changes in characteristics. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Soil potential ratings are based on the practices commonly used in the survey area to overcome soil limitations. These ratings reflect the ease of overcoming the limitations. They also reflect the problems that will persist even if such practices are used.

Each map unit is rated for *cultivated crops, tame pasture, urban uses,* and *recreation areas.* Cultivated crops are those grown extensively in the survey area. Pasture refers to areas of native or introduced grasses. Urban uses include residential, commercial, and industrial developments. Intensive recreation areas are campsites, picnic areas, ballfields, and other areas that are subject to heavy foot traffic. Extensive recreation areas are those used for nature study and as wilderness.

Deep, moderately well drained and well drained, sandy, loamy, and clayey soils; on flood plains

The three map units in this group make up about 10.8 percent of Murray County. The soils are used mainly as cropland, tame pasture, and hayland.

1. Garvin-Elandco

Deep, nearly level and very gently sloping, moderately well drained and well drained, clayey and loamy soils that formed in clayey or loamy alluvium

This map unit is made up of nearly level to very gently sloping soils on flood plains, mainly along Chigley Sandy Creek, Guy Sandy Creek, Mill Creek, and Rock Creek, and along some of the major drainageways within the county. Slopes range from 0 to 2 percent.

Variations in landform are limited to minor changes in elevation. Vegetative patterns are diverse; scattered areas of cropland are interspersed with trees. There are few structures. Water elements consist of drainageways that commonly run the length of the unit. Visual diversity in this map unit is moderate. Changes may be visually significant unless efforts are made to blend with the surrounding landscape.

This map unit makes up about 4.4 percent of the county. It is about 50 percent Garvin soils, 40 percent Elandco soils, and 10 percent soils of minor extent.

Garvin soils are at slightly higher elevations on the flood plain and are on narrow areas adjacent to the stream channels. These soils are deep, nearly level, and moderately well drained. Some areas are concave. Areas of these soils are subject to occasional or frequent, very brief or brief periods of flooding. Typically, the Garvin soils have a surface layer of dark grayish brown silty clay. The next layer is dark gray silty clay. The subsoil is reddish brown and brown silty clay. The underlying material is reddish brown and strong brown silty clay and silty clay loam.

Elandco soils are at the higher elevations on the flood plain and are on narrow areas adjacent to the stream channels. These soils are deep, nearly level to very gently sloping, and well drained. Areas of these soils are subject to occasional or frequent, very brief or brief periods of flooding. Typically, the Elandco soils have a surface layer of dark grayish brown silt loam. The next layer is brown silty clay loam, and the underlying material is yellowish brown silty clay loam.

Of minor extent in this map unit are the moderately well drained to well drained Burleson, Chigley, Clarita, and Durant soils. These soils are on side slopes adjacent to the flood plain.

The soils of this map unit are used mainly for tame pasture, hay, and cultivated crops. The main crops are small grain, grain sorghum, and alfalfa. The major management concerns are controlling flooding and maintaining soil structure and fertility.

These soils have medium potential for cultivated crops and high potential for tame pasture and native grass. Potential is low for building sites and most sanitary facilities. Potential is also low for recreational development. Flooding, shrinking and swelling, very slow permeability, and clayey texture are the main limitations.

2. Yahola-Dale

Deep, nearly level, well drained, sandy and loamy soils that formed in loamy alluvium

This map unit is made up of nearly level soils on the flood plain of the Washita River. Slopes are 0 to about 1 percent.

Landforms in this map unit have very little variation. The fertile soils of this map unit encourage extensive crop production, which results in little variety in vegetative pattern. The Washita River and drainageways entering it are the water elements in the unit; these provide some diversity. Structures are uncommon because of the hazard of flooding. Visual diversity in this map unit is low. Changes will generally be visually significant.

This map unit makes up about 4.6 percent of the county. It is about 34 percent Yahola soils, 22 percent Dale soils, and 44 percent soils of minor extent.

Yahola soils are at the lowest elevations on the flood plains adjacent to the stream channel. Areas of these soils are subject to occasional or frequent, very brief periods of flooding. Typically, the Yahola soils have a surface layer of brown and yellowish red fine sandy loam or loamy fine sand. The underlying material is reddish yellow and reddish brown fine sandy loam that is stratified with silt loam.

Dale soils are at the highest elevations on the flood plain. Flooding is rare. Typically, the Dale soils have a surface layer of dark reddish gray silt loam. The subsoil is yellowish red silt loam, and the underlying material is red silt loam.

Of minor extent in this map unit are the moderately well drained McLain soils on landscapes in slightly lower positions than the Dale soil. Of lesser extent are the Watonga soils on landscapes in the lowest positions. Elandco and Garvin soils are on landscape positions similar to those of the Yahola soils on the Washita River.

The soils of this map unit are used mainly for cultivated crops, tame pasture, and hay. The main crops are small grain, grain sorghum, soybeans and alfalfa. The major management concerns are controlling flooding and maintaining soil structure and fertility.

These soils have high potential for cultivated crops, tame pasture, and native grass. Potential is low for building sites and most sanitary facilities. Potential is medium for recreational development. Seepage, flooding, moderate permeability, and shrinking and swelling are the main limitations.

3. Watonga-McLain

Deep, nearly level, moderately well drained, clayey and loamy soils that formed in clayey and loamy alluvium

This map unit is made up of nearly level soils on the flood plain of the Washita River. Slopes are 0 to about 1 percent and are concave.

The nearly level soils of this unit provide only limited diversity in landform. Cropland areas offer little or no variation in vegetative pattern except in areas where woody vegetation has developed along drainageways. Water elements and structures are uncommon and provide little diversity. Visual diversity in this map unit is low. In most cases changes will be visually significant.

This map unit makes up about 1.8 percent of the county. It is about 75 percent Watonga soils, 20 percent McLain soils, and 5 percent soils of minor extent.

Watonga soils are at lower elevations on the flood plain on broad flats. Flooding is rare. Typically, the Watonga soils have a surface layer of very dark gray clay or dark gray silty clay loam. The subsoil is dark grayish brown clay or silty clay. The underlying material is reddish brown clay or dark brown silty clay.

McLain soils are at higher elevations on the flood plain on broad flats. Flooding is rare. Typically, the McLain soils have a surface layer of dark reddish brown silty clay loam. The subsoil is yellowish red silty clay loam or red silty clay. The underlying material is red silt loam.

Of minor extent in this map unit are the well drained Dale and Yahola soils. The Dale soils are in slightly higher landscape positions than McLain soils, and the Yahola soils are in the lowest landscape positions. Of lesser extent are the Elandco and Garvin soils along tributaries of the Washita River.

The soils of this map unit are used mainly for cultivated crops, tame pasture, and hay. The main crops are small grain, grain sorghum, soybeans, and alfalfa. The major management concerns are controlling flooding and maintaining soil structure and fertility.

These soils have high potential for cultivated crops, tame pasture, and native grass. Potential is low for building sites and some sanitary facilities. Potential is also low for recreational development. Flooding, very slow or slow permeability, shrinking and swelling, and clayey texture are the main limitations.

Deep, shallow, and very shallow, well drained and moderately well drained, sandy, loamy, and clayey soils; on uplands

The five map units in this group make up about 45.4 percent of Murray County. The soils are used mainly as tame pasture, range, and hayland. Some areas are used for cultivated crops.

4. Clarita-Durant-Burleson

Deep, nearly level to strongly sloping, moderately well drained, clayey and loamy soils that formed in clayey material

This map unit is made up of nearly level to strongly sloping soils on side slopes and low ridgetops of uplands. Although this map unit occurs throughout the county, areas are mainly east of the Washita River. Slopes range from 0 to 12 percent.

The rolling topography of this map unit produces some variation in landforms. The vegetation is scattered trees on native grassland. Small drainageways and farm ponds provide variety in water elements. Visual diversity in this map unit is moderate. Changes in the landscape can be visually significant.

This map unit covers about 23.7 percent of the county. It is about 55 percent Clarita soils, 29 percent Durant soils, 6 percent Burleson soils, and 10 percent soils of minor extent.

Clarita soils are on ridgetops and side slopes. These soils are deep, very gently sloping to strongly sloping, and moderately well drained. Typically, the Clarita soils have a surface layer of brown clay. The subsoil is brown and reddish brown clay. The underlying material is yellowish red clay.

Durant soils are on side slopes and broad flats. These soils are deep, nearly level to gently sloping, and moderately well drained. Typically, the Durant soils have a surface layer of dark grayish brown loam. The subsoil is grayish brown and brownish yellow clay or clay loam.

Burleson soils are on broad flats. These soils are deep, very gently sloping, and moderately well drained. Typically, the Burleson soils have a surface layer of dark gray and very dark gray clay. The subsoil is dark grayish brown clay in the upper part and coarsely mottled clay in the lower part.

Of minor extent in this map unit are the well drained and moderately well drained Grainola, Wilson, and Renfrow soils. Areas of these soils dissect the map unit. Of lesser extent are the Elandco and Garvin soils on narrow flood plains and the Bastrop, Chigley, Claremore, Fitzhugh, Gasil, Kiti, and Rayford soils on uplands.

The soils of this map unit are used mainly for tame pasture, hay, and range. Other areas are cultivated. The main crops are small grain and grain sorghum. The major management concerns are maintaining fertility and soil structure, controlling erosion, proper stocking, protecting from burning, and controlling grazing.

These soils have low potential for cultivated crops and medium potential for tame pasture and native grass. Potential is low for building sites and most sanitary facilities. Potential is also low for recreational development. Clayey texture, very slow permeability, and shrinking and swelling are the main limitations.

5. Shidler-Claremore-Clarita

Very shallow, shallow, and deep, very gently sloping to strongly sloping, well drained and moderately well drained, loamy and clayey soils that formed in loamy material weathered from limestone or formed in clay

This map unit is made up of very gently sloping to strongly sloping soils on broad flats or side slopes of uplands. The areas are mainly in the extreme eastern part of the county, but they do occur in other areas. Slopes range from 1 to 12 percent.

Small shrubby plants and native grasses provide some diversity in the vegetative patterns of this map unit. Varied landforms result from the range in slope. Visual diversity in this map unit is moderate. Changes in the landscape can be visually significant; they require careful siting to blend with the surrounding landscape.

This map unit covers about 8.0 percent of the county. It is about 36 percent Shidler soils, 33 percent Claremore soils, 8 percent Clarita soils, and 23 percent soils of minor extent.

Shidler soils are on ridgetops. These soils are very shallow or shallow, very gently sloping to sloping, and well drained. Typically, the Shidler soils have a surface layer of reddish brown silty clay loam. The underlying material is hard grayish limestone that is tilted less than 20 degrees from horizontal.

Claremore soils are on convex ridgetops. These soils are shallow, very gently sloping or gently sloping, and well drained. Typically, the Claremore soils have a surface layer of dark grayish brown loam. The subsoil is brown clay loam. The underlying material is hard limestone that is tilted less than 20 degrees from horizontal.

Clarita soils are on side slopes. These soils are deep, very gently sloping to strongly sloping, and moderately well drained. Typically, the Clarita soils have a surface layer of dark gray and dark grayish brown silty clay. The subsoil is reddish brown silty clay.

Of minor extent in this map unit are the well drained to somewhat poorly drained Catoosa, Darnell Variant, Fitzhugh, and Stephenville Variant soils. Areas of these soils dissect the map unit. Of lesser extent are the Elandco and Garvin soils on narrow flood plains and the Durant, Gasil, and Wilson soils on uplands. Also included are areas of Rock outcrop that are associated with Shidler and Claremore soils.

The soils of this map unit are used mainly for range, tame pasture, and hay. Some areas can be cultivated. Probable main crops would be small grain and grain sorghum. The major management concerns are controlling grazing, maintaining fertility and soil structure, proper stocking, controlling erosion, and protecting from burning.

These soils have low potential for cultivated crops and tame pasture and medium potential for range. Potential is low for building sites and most sanitary facilities. Potential is also low for recreational development. Depth to rock, surface stoniness, clayey texture, and shrinking and swelling are the main limitations.

6. Chigley-Clarita

Deep, very gently sloping to strongly sloping, moderately well drained, loamy and clayey soils that formed in material weathered from conglomerate rock or formed in clay

This map unit is made up of very gently sloping to strongly sloping soils on side slopes and ridgetops throughout the central and north-central parts of the county. Slopes range from 1 to 12 percent.

The side slopes and ridgetops in this map unit create varied and diverse landforms. Varied vegetative patterns are formed by scattered wooded areas and native grass openings. Small ponds and drainageways make up the water features in this map unit. Some structures are built from native rock, which blends effectively with the surrounding landscape. Visual diversity in this map unit is high. Changes will be visually insignificant in most situations.

This map unit covers about 6.0 percent of the county. It is about 77 percent Chigley soils, 18 percent Clarita soils, and 5 percent soils of minor extent.

Chigley soils are on ridgetops and side slopes of uplands. These soils are deep, very gently sloping to strongly sloping, and moderately well drained. Typically, the Chigley soils have a surface layer of brown gravelly sandy loam. The upper part of the subsoil is yellowish red, light yellowish brown, and red gravelly clay. The lower part of the subsoil is reddish yellow clay. The underlying material is yellowish brown clay.

Clarita soils are on ridgetops of uplands. These soils are deep, very gently sloping to sloping, and moderately well drained. Typically, the Clarita soils have a surface layer of dark grayish brown clay. The subsoil is brown and reddish brown clay.

Of minor extent in this map unit are the well drained or moderately well drained Bastrop, Durant, and Tussy soils. Areas of these soils dissect the map unit. Of lesser extent are the Elandco and Garvin soils on narrow flood plains.

The soils of this map unit are used mainly for tame pasture, hay, and range. Other areas are cultivated. The main crops are small grain and grain sorghum. The major management concerns are maintaining fertility, controlling grazing, proper stocking, protecting from burning, and controlling erosion.

These soils have low potential for cultivated crops and medium potential for tame pasture and native grass. Potential is low for building sites and most sanitary facilities. Potential is also low for recreational development. Clayey texture, very slow to moderately slow permeability, and shrinking and swelling are the main limitations.

7. Bastrop-Gasil-Konawa

Deep, nearly level to sloping, well drained, loamy soils that formed in loamy sediment or loamy alluvium

This map unit is made up of nearly level to sloping soils on smooth uplands. The areas are near the Washita River throughout the county. Slopes range from 0 to 8 percent.

The landforms of this unit have some variation because of the slopes. Vegetative patterns are scattered trees and native grass areas. Drainageways and manmade ponds are the major water elements. Visual diversity of this map unit is moderate. Changes in the landscape can be visually significant in some situations.

This map unit covers about 3.7 percent of the county. It is about 39 percent Bastrop soils, 31 percent Gasil soils, 14 percent Konawa soils, and 16 percent soils of minor extent.

Bastrop soils are on smooth and convex uplands. These soils are deep, very gently sloping to sloping, and well drained. Typically, the Bastrop soils have a surface layer of brown and reddish brown fine sandy loam and loam. The upper part of the subsoil is yellowish red to red clay loam or sandy clay loam. The lower part of the subsoil is red, yellowish red, and reddish yellow clay loam or sandy clay loam.

Gasil soils are on smooth uplands. These soils are deep, very gently sloping to gently sloping, and well drained. Typically, the Gasil soils have a surface layer of brown fine sandy loam or sandy loam. The upper part of the subsoil is brown, yellowish brown, and light brown sandy clay loam. The lower part of the subsoil is reddish yellow sandy clay loam or fine sandy loam. The underlying material is weakly consolidated sandstone or packsand.

Konawa soils are on smooth uplands. These soils are deep, nearly level to sloping, and well drained. Typically, the Konawa soils have a surface layer of brown fine sandy loam and a subsurface layer of light brown loamy fine sand. The upper part of the subsoil is yellowish red to red sandy clay loam. The lower part of the subsoil is yellowish red to red fine sandy loam.

Of minor extent in this map unit are the well drained Eufaula, Konsil, and Teller soils on adjacent side slopes and ridgetops that dissect the map unit. Of lesser extent are the Elandco and Garvin soils on narrow flood plains and the Chigley, Durant, and Clarita soils on uplands.

The soils of this map unit are used mainly for tame pasture, hay, or cultivated crops. Other areas are used for rangeland. The main crops are small grain, grain sorghum, and alfalfa. The major management concerns are maintaining soil structure and fertility and controlling erosion.

These soils have medium potential for cultivated crops, tame pasture, and hay. Potential is high for building sites and medium for most sanitary facilities. Potential is high for recreational development. Sandy texture and seepage are the main limitations.

8. Fitzhugh-Lula

Deep, very gently sloping and gently sloping, well drained, loamy soils that formed in loamy material weathered from interbedded sandstone and sandy shale or from limestone

This map unit is made up of very gently sloping and gently sloping soils on uplands in the eastern part of the county. Slopes range from 1 to 5 percent.

The gentle slopes of the landforms in this map unit add some variety to the landscape. Vegetative patterns are limited in diversity; the majority of the map unit is used for tame pasture, range, or cropland. Limited water elements are drainageways and ponds. Visual diversity for this map unit is moderate. Changes in the landscape can be visually significant in some cases.

This map unit covers about 4.0 percent of the county. It is about 37 percent Fitzhugh soils, 36 percent Lula soils, and 27 percent soils of minor extent.

Fitzhugh soils are on slightly rolling uplands. These soils are deep, very gently sloping and gently sloping, and well drained. Typically, the Fitzhugh soils have a surface layer of brown and dark brown loam. The upper part of the subsoil is yellowish brown, red, brown, and reddish brown clay loam. The lower part is red and reddish brown sandy clay loam or clay loam. The underlying material is interbedded sandstone and sandy shale.

Lula soils are on smooth and convex slopes. These soils are deep, very gently sloping, and well drained. Typically, the Lula soils have a surface layer of brown silt loam. The upper part of the subsoil is reddish brown silt loam and silty clay loam. The lower part of the subsoil is red silty clay loam. The underlying material is hard limestone.

Of minor extent in this map unit are the well drained and moderately well drained Catoosa, Claremore, Clarita, and Shidler soils. Areas of these soils dissect the map unit. Of lesser extent are the Elandco and Garvin soils on narrow flood plains and Durant and Gasil soils on uplands.

The soils of this map unit are used mainly for tame pasture, hay, and range. Some areas are in cropland. The main crops are small grain and grain sorghum. The major management concerns are maintaining fertility and soil structure, controlling erosion, proper stocking, controlling grazing, and protecting from burning.

These soils have high potential for cultivated crops, tame pasture, hay, and range. Potential is medium for building sites and most sanitary facilities. Potential is high for recreational development. Depth to rock and shrinking and swelling are the main limitations.

Very shallow to deep, well drained and moderately well drained, loamy and clayey soils and Rock outcrop; on mountains

The two map units in this group make up about 43.8 percent of Murray County. The soils are used mainly for range, tame pasture, and hay.

9. Kiti-Rock outcrop-Rayford

Shallow and very shallow, very gently sloping to steep, well drained, loamy soils that formed in loamy material weathered from tilted limestone, limestone conglomerate, and outcrops of rock

This map unit is made up of very gently sloping to steep soils on ridgetops and side slopes of hills in the western and southeastern parts of the county. Slopes range from 2 to 45 percent.

The tilted geologic structure of this map unit creates a high degree of diversity among landforms. Various trees, shrubs, and native grasses provide variation in the vegetative patterns. Water elements are limited to drainageways and occasional ponds. Visual diversity in this map unit is high. Changes in the landscape will be visually insignificant.

This map unit covers about 40.2 percent of the county. It is about 34 percent Kiti soils, 27 percent Rock outcrop, 9 percent Rayford soils, and 30 percent soils of minor extent.

Kiti soils are on side slopes and ridgetops of hills in a complex with Rock outcrop. These soils are shallow or very shallow, very gently sloping to steep, and well drained. Typically, the Kiti soils have a surface layer of dark grayish brown very flaggy loam or very flaggy silty clay loam. The underlying material is hard limestone that is tilted more than 20 degrees from horizontal.

Rock outcrop is on side slopes and ridgetops of hills. Typically, it consists of almost vertical outcrops of limestone that are tilted at about a 45 degree angle. The strata are about 5 to 15 inches thick, 3 to 36 inches high, and appear as long, narrow rows of edgerock.

Rayford soils are on side slopes of hills. These soils are shallow, sloping to moderately steep, and well drained. Typically, the Rayford soils have a surface layer of dark grayish brown cobbly loam. The next layer is brown very cobbly clay loam. The underlying material is hard limestone conglomerate.

Of minor extent are the moderately well drained to excessively drained Gasil Variant, Kingfisher Variant, Norge Variant, Scullin, and Timhill soils and areas of Pits. Areas of these soils dissect the map unit. Of lesser extent are the Elandco and Garvin soils on narrow flood plains.

The soils of this map unit are used mainly for range, tame pasture, and hay. The major management concerns are controlling grazing, proper stocking, maintaining fertility, controlling erosion, and protecting from burning.

These soils have low potential for cultivated crops, tame pasture, and range. Potential is low for building sites and sanitary facilities. Potential is low for recreational development. Depth to rock, surface stones, rock outcrops, and shrinking and swelling are the main limitations.

10. Chigley-Travertine-Naru

Deep to shallow, very gently sloping to steep, moderately well drained and well drained, loamy soils that formed in clayey material weathered from conglomerate rock and loamy material weathered from colluvium or shale and siltstone

This map unit is made up of very gently sloping to steep soils on gently rolling and steep hills, mainly in the south-central and southeastern parts of the county. Slopes range from 2 to 30 percent.

The landforms of this map unit provide diversity. The vegetative patterns consist of various species of native hardwood, evergreens, and native grasses. Water elements consist of lakes and drainageways with high clarity and diverse shorelines. Structures in this map unit are not readily apparent. The visual diversity of this map unit is high. Changes in the landscape will be visually insignificant.

This map unit covers about 3.6 percent of the county. It is about 21 percent Chigley soils, 19 percent Travertine soils, 17 percent Naru soils, and 43 percent soils of minor extent.

Chigley soils are on ridgecrests and side slopes of uplands. These soils are deep, very gently sloping to steep, and moderately well drained. Typically, the Chigley soils have a surface layer of brown and light brown gravelly sandy loam. The upper part of the subsoil is red gravelly clay loam. The lower part of the subsoil is yellowish red gravelly clay loam. The upper part of the underlying material is strong brown sandy clay loam. The lower part of the underlying material is hard conglomerate.

Travertine soils are on shoulders and summits of hills or ridges of uplands. These soils are shallow, sloping, and well drained. Typically, the Travertine soils have a surface layer of pale brown channery silt loam. The subsoil is pink extremely channery loam. The underlying material is platy shale and siltstone.

Naru soils are on side slopes of uplands. These soils are moderately deep, sloping to steep, and well drained. Typically, the Naru soils have a surface layer of brown and light brown cobbly loam. The subsoil is reddish brown cobbly loam. The upper part of the underlying material is mottled shaly clay. The lower part of the underlying material is light gray conglomerate.

Of minor extent are the well drained Bromide, Gasil Variant, Rayford, and Kiti soils. Of lesser extent are the Elandco and Garvin soils on narrow flood plains.

The soils of this map unit are used mainly for tame pasture and range. The major management concerns are controlling grazing, proper stocking, maintaining fertility, controlling erosion, and protecting from burning.

These soils have low potential for cultivated crops, tame pasture, and range. Potential is low for building sites and sanitary facilities. Potential is also low for recreational development. Shallow depth to rock and shrinking and swelling are the main limitations.

Landscape Resources

The appearance, or visual quality, of an area is an important natural resource. The visual landscape resources of Murray County are the landforms, vegetation, water elements, and manmade structures of the county. As with any natural resource, landscape resources are finite and should be properly managed for effective conservation.

The landscape of each general soil map unit has a distinct appearance. Changing the pattern of the landscape resources modifies this appearance. In some areas, the pattern has been extensively changed by agricultural practices or urban expansion.

In each of the general soil map units for Murray County, the visual diversity of the landscape is described and rated. These descriptions are based on a comparison of landscapes within the county and the patterns that are created by the basic landscape elements.

The pattern of elements in a landscape is readily visible, and the diversity of that landscape can be rated as high, medium, or low. A landscape that has high visual diversity will have some or all of the following characteristics—

- variations in landforms,
- unique plant communities or varied vegetative patterns,
- rivers or streams that have high clarity and lakes or ponds that possess diverse shorelines, and
- manmade structures that harmonize with the landscape and other structures.

In areas of low visual diversity, one landscape element can dominate. This creates a monotonous appearance and offers little or no contrast in pattern. Areas of low diversity have some of the following characteristics—

- landforms with no variety,
- continuous vegetative cover that has no variation in type, height, or color,
- water bodies that offer limited visual interest, and shorelines that have no variety, and
- manmade structures that bear little relation to their surroundings.

Before making any change in land use, the potential impact on the landscape resources should be carefully analyzed. Often, a single practice can increase or decrease the quality of the landscape resources. The grading and revegetating of an eroded area, for example, will increase landscape resource quality. On the other hand, if a sloping area that has soil suitable for woodland is cleared and planted to row crops, the soil may erode severely during winter months if it is not protected by vegetative cover. A severely eroded soil would decrease the landscape resource quality. The result could be bare, unsightly eroded areas, loss of soil, a decrease in water quality because of silt loading, and loss of other vegetative areas caused by increased runoff.

A knowledge of each landscape element and the effect of land use changes on the landscape are necessary to properly manage landscape resources. Assistance in landscape resource planning is available from the Soil Conservation Service field office in Murray County. Proper consideration of the soil characteristics, land use, and the landscape elements will enhance or preserve the optimal quality of the landscape resources of an area.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Durant loam, 1 to 3 percent slopes, is one of several phases in the Durant series.

Some map units are made up of two or more major soils. These map units are called soil complexes or undifferentiated groups.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Kiti-Scullin complex, 2 to 6 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in a mapped area are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Chigley and Clarita soils, 2 to 6 percent slopes, gullied, is an undifferentiated group in this survey area.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, quarries, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

1—Bastrop fine sandy loam, 1 to 3 percent slopes. This deep, well drained, very gently sloping soil is on broad ridges of high terraces along the Washita River. Slopes are commonly smooth and convex. Individual areas range from 15 to 40 acres.

Typically, the surface layer is brown fine sandy loam about 8 inches thick. The upper part of the subsoil, to a depth of 37 inches, is yellowish red clay loam. The lower part of the subsoil is red clay loam to a depth of about 70 inches.

This soil is medium in natural fertility and low in organic matter content. It is slightly acid or neutral throughout. The rate of water movement through this soil is moderate, and the available water capacity is high. The root zone is deep and is favorable for root growth. This soil has good tilth and can be worked throughout a wide range of moisture content.

Included with this soil in mapping are small, scattered areas of Konawa soils. Also included at the upper boundary of some mapped areas are small areas of Clarita and Chigley soils. The included soils make up about 10 percent of this map unit. Separate areas of included soils are generally less than 3 acres.

Areas of this Bastrop soil are used mainly as tame pasture. Some areas are cultivated to forage sorghum. A minor acreage is used as range.

This Bastrop soil has high potential for cropland. Management concerns for crops are controlling erosion and maintaining soil tilth and fertility. Adding fertilizer helps to increase plant growth. This provides more crop residue to help maintain soil tilth and fertility. Minimum tillage, terraces, farming on the contour, stripcropping, and using crop residue help to control soil erosion. Winter cover crops furnish additional protection against wind and water erosion.

This soil has high potential for native grass and tame pasture. Bermudagrass or weeping lovegrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of the grass. The additional plant growth helps to protect the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has high potential for most urban uses. There are no significant limitations for sanitary landfills, dwellings, and small commercial buildings. Seepage is the main limitation for sewage lagoons, and moderate permeability is the main limitation for septic tank absorption fields. These limitations generally can be overcome by proper design or by altering the soil.

This Bastrop soil is in capability subclass IIe and in the Sandy Savannah range site.

2—Bastrop fine sandy loam, 5 to 8 percent slopes. This deep, well drained, strongly sloping soil is on side slopes of high terraces along the Washita River. Slopes are commonly smooth and convex. Individual areas range from 10 to 40 acres.

Typically, the surface layer is brown fine sandy loam about 12 inches thick. The upper part of the subsoil, to a depth of 28 inches, is yellowish red clay loam. The lower part of the subsoil is red clay loam to a depth of about 72 inches.

This soil is medium in natural fertility and low in organic matter content. It is slightly acid or neutral throughout. The rate of water movement through this soil is moderate, and the available water capacity is high. The root zone is deep and is favorable for root growth. This soil has good tilth and can be worked throughout a wide range of moisture content.

Included with this soil in mapping are small areas of Konawa soils. Also included are small areas of a soil that has a very dark brown surface layer and a clayey subsoil. These included soils make up about 15 percent of the map unit. Separate areas of included soils are generally less than 3 acres.

Areas of this Bastrop soil are used mainly as tame pasture. A minor acreage is used as range.

This Bastrop soil has medium potential for cropland. Management concerns for crops are controlling erosion and maintaining soil tilth and fertility. Adding fertilizer helps to increase plant growth. This provides more crop residue to help maintain soil tilth and fertility. Minimum tillage, terraces, farming on the contour, stripcropping, and using crop residue help to control soil erosion. Winter cover crops furnish additional protection against wind and water erosion.

This soil has high potential for native grass and tame pasture. Bermudagrass or weeping lovegrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of the grass. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has high potential for most urban uses. There are no significant limitations for sanitary landfills and dwellings. Slope is the main limitation for small commercial buildings. Seepage and moderate permeability are the main limitations for septic tank absorption fields. Slope is the main limitation for sewage lagoons. These limitations generally can be overcome by proper design or by altering the soil.

This Bastrop soil is in capability subclass IVe and in the Sandy Savannah range site.

3—Bastrop loam, 1 to 5 percent slopes, eroded. This deep, well drained, very gently sloping to sloping, eroded soil is on ridges and side slopes of high terraces along the Washita River. Rills are common between small, crossable gullies that are about 100 to 200 feet apart. In about 40 percent of the area, plowing has mixed the surface layer and material from the upper part of the subsoil. Slopes are commonly smooth, except where there are small gullies. Individual areas are 10 to 30 acres.

Typically, the surface layer is reddish brown loam about 7 inches thick. The upper part of the subsoil, to a depth of 27 inches, is red sandy clay loam. The middle part, to a depth of 49 inches, is red clay loam. The lower part of the subsoil is yellowish red sandy clay loam to a depth of about 79 inches.

This soil is low in natural fertility and organic matter content. It is slightly acid or neutral throughout. The rate of water movement through this soil is moderate, and the available water capacity is high. The root zone is deep and is favorable for root growth. This soil has fair tilth and can be worked only within a medium range of moisture content.

Included with this soil in mapping are small areas of Konawa soils. Also included are small areas of a soil that has a dark brown surface layer and a clayey subsoil. These included soils make up about 15 percent of the map unit; separate areas are generally less than 3 acres.

Areas of this Bastrop soil are used mainly as tame pasture. A minor acreage is used as range.

This Bastrop soil has medium potential for cropland. Proper management is needed to protect the soil against further rill and gully erosion and to maintain or improve soil tilth and fertility. Adding fertilizer helps to increase plant growth. This provides more crop residue to help maintain soil tilth and fertility. Minimum tillage, terraces, farming on the contour, stripcropping, and using crop residue help to control soil erosion. Winter cover crops furnish additional protection against wind and water erosion.

This soil has medium potential for native grass and tame pasture. Bermudagrass or weeping lovegrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of the grass. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has high potential for most urban uses. There are no significant limitations for sanitary landfills and dwellings. Slope is the main limitation for small commercial buildings. Seepage, slope, and moderate permeability are the main limitations for sewage lagoons and septic tank absorption fields. These limitations generally can be overcome by proper design or by altering the soil.

This Bastrop soil is in capability subclass IIIe and in the Sandy Savannah range site.

4—Bastrop-Urban land complex, 1 to 5 percent slopes. This complex is on broad, high terraces along the Washita River. The complex is broad and generally uniform in shape. The Bastrop soils and Urban land in this complex occur in such an intricate pattern that it is impractical to separate them at the scale selected for mapping. The complex is 60 percent Bastrop soils, 25 percent Urban land, and 15 percent Konawa and Durant soils.

Typically, the surface layer of the Bastrop soils is brown fine sandy loam about 8 inches thick. The subsoil is clay loam to a depth of about 70 inches. The upper part, to a depth of about 37 inches, is yellowish red. The lower part is red.

The Bastrop soils are medium in natural fertility and low in organic matter content. They are slightly acid to neutral throughout. The rate of water movement through the soil is moderate, and the available water capacity is high. The root zone is deep and is favorable for plant growth.

Urban land consists of areas that are covered mostly by single-unit dwellings, streets, driveways, sidewalks, commercial buildings, and patios.

The more sloping areas of Bastrop soils in this complex have been modified by excavating, filling, and grading for building sites and dwellings. This alteration can range in depth from a few inches to more than a foot, depending on the slope. In excavated and filled areas, the surface layer is a mixture of loamy materials. Although the thickness of the soil layers differs widely from those described for the Bastrop soils, the basic characteristics remain very similar.

Areas of the soils in this complex are used mostly for urban development, mainly picnic areas, playground areas, houses, roads, and streets.

The main concerns in using these soils as urban areas are moderate permeability, slope, and low strength. The soils have slight limitations for sanitary landfills, daily cover for landfills, shallow excavations, dwellings, small commercial buildings, lawns and landscaping, and golf fairways. They have moderate limitations for septic tank absorption fields, sewage lagoons, and local roads and streets. The soils are moderately suited to uncoated steel and well suited to concrete. Most of the limitations can be overcome by proper design or by altering the soil. These soils are well suited to trees, garden plants, shrubs, and flowers.

This complex is not placed in a capability subclass or range site.

5—Bastrop and Konawa soils, 3 to 8 percent slopes, gullied. These deep, well drained, gently sloping to sloping, gullied soils are on slopes of high terraces along the Washita River. They are on foot slopes or side slopes that have been deeply gullied by water erosion. Areas of each soil are large enough to be mapped separately; but, because of present and predicted use, they were mapped as one unit. About 30 percent of the mapped areas contain both soils; the other areas contain only one of the soils. On about 50 percent of the acreage, part of the original surface layer has been removed by erosion. On about 25 percent of the acreage, the original surface layer and material from the upper part of the subsoil have been mixed by tillage. Gullies are 10 to 100 feet apart, 2 to 8 feet deep, and 2 to 15 feet across. Individual mapped areas range from 5 to 40 acres.

Bastrop soils make up about 50 percent of the map unit. Typically, the surface layer is reddish brown fine sandy loam about 4 inches thick. The upper part of the subsoil is yellowish red clay loam to a depth of 46 inches. The lower part is reddish yellow sandy clay loam to a depth of about 72 inches.

Bastrop soils are medium acid or slightly acid. They are low in natural fertility and organic matter content. The rate of water movement through the soil is moderate, and the available water capacity is high. The root zone is deep and is favorable for root growth.

Konawa soils make up about 30 percent of the map unit. Typically, the surface layer is light brownish gray loamy fine sand about 10 inches thick. The upper part of the subsoil, to a depth of 26 inches, is yellowish red sandy clay loam. The lower part of the subsoil, to a depth of 50 inches, is yellowish red fine sandy loam. The underlying material is yellowish red loamy fine sand to a depth of 72 inches.

The Konawa soils are strongly acid to slightly acid in the surface layer and medium acid or strongly acid in the subsoil. They are low in natural fertility and organic matter content. The rate of water movement through the soil is moderate, and the available water capacity is medium. The root zone is deep and is favorable for root growth.

Included with these soils in mapping are small areas of a soil that has a clayey subsoil. This inclusion makes up about 10 percent of the map unit; separate areas are generally less than 2 acres. Gullies make up about 10 percent of the map unit.

All areas of these Bastrop and Konawa soils have been cultivated in the past. Most areas are presently seeded to grass and are used as tame pasture or range. The potential is low for native range. Low fertility and a very severe erosion hazard are the main limitations.

These soils have medium to low potential for growing tame pasture grasses if the eroded areas are smoothed and reclaimed. Moderate yields can be obtained if management is intensive. Renovating and planting grass in gullied areas help to control erosion. Bermudagrass or weeping lovegrass and clovers are commonly used in tame pastures. Fertilizing tame pasture increases the amount of forage and improves the vigor of the grass stand. The quality of tame pasture grasses can be improved by controlling grazing, proper stocking, and preventing fires.

These soils have very low potential as cropland because of the uncrossable gullies. Extensive cutting and filling is required in order to reclaim these areas for cropland. The erosion hazard is very severe.

These soils have medium potential for most urban uses. The gullies are the main limitation; major land smoothing would be required. Seepage is the main limitation for sewage lagoons. Low strength is the main limitation for roads and streets. Most of these limitations can be overcome by proper design or by altering the soil.

This map unit is in capability subclass VIe and in the Eroded Sandy Savannah range site.

6—Burleson clay, 1 to 3 percent slopes. This deep, moderately well drained, very gently sloping soil is in the central and southeastern parts of the county. Slopes are simple and mainly less than 2 percent. Individual areas range from 5 to 20 acres.

Typically, the surface layer is dark gray and very dark gray clay to a depth of about 29 inches. Below this, the soil is clay. It is dark grayish brown and mottled to a depth of about 50 inches and coarsely mottled dark grayish brown, light olive gray, pale brown, and pale olive to a depth of about 72 inches.

This soil is high in natural fertility and organic matter content. It is neutral or mildly alkaline in the surface layer and mildly alkaline or moderately alkaline below. The rate of water movement through this soil generally is very slow, but water movement is rapid if the soil is dry and cracked. The available water capacity is high. The root zone is deep and is favorable for root growth.

Included with this soil in mapping are small areas of Durant soils. Also included is a soil that has a very dark grayish brown silt loam surface layer and a silty clay loam subsoil. These included soils make up about 10 percent of this map unit. Separate areas of included soils generally are less than 3 acres.

Areas of this soil are used mainly for small grains. Some areas are in tame pasture, and a minor acreage is in native range.

This soil has high potential for cropland. Management concerns for crops are controlling erosion and maintaining soil tilth and fertility. Adding fertilizer helps to increase plant growth. This provides more crop residue to help maintain soil tilth and fertility. Minimum tillage, terraces, farming on the contour, stripcropping, and using crop residue help to control soil erosion. Winter cover crops furnish additional protection against wind and water erosion.

The soil has high potential for native grass and tame pasture. Bermudagrass is commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of the grass. The added plant growth helps to protect the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has low potential for most urban uses. There are significant limitations that restrict its use for trench sanitary landfills, dwellings, small commercial buildings, and local roads and streets. The soil is too clayey for trench sanitary landfills. The shrinking and swelling of the soil is a limitation for dwellings, small commercial buildings, and local roads and streets. Very slow permeability is a limitation for septic tank absorption fields. There are no significant limitations for sewage lagoons. Most of the limitations can be overcome by proper design or by altering the soil.

This Burleson soil is in capability subclass IIe and in the Blackclay Prairie range site.

7—Catoosa-Shidler complex, 2 to 8 percent slopes. This complex consists of moderately deep, well drained Catoosa soils and very shallow, well drained Shidler soils on uplands. These very gently sloping to sloping soils are on convex ridges and upper side slopes. They occur mainly in the northern and eastern parts of the county. Areas of these soils are so intermingled that they cannot be shown separately at the scale selected for mapping. Individual areas range from 20 to 200 acres.

Catoosa soils make up about 55 percent of the complex. Typically, the surface layer is reddish brown silt loam about 10 inches thick. The subsoil is silty clay loam to a depth of about 29 inches. It is reddish brown in the upper part and red in the lower part. The underlying material is hard, fractured limestone bedrock.

The Catoosa soils are high in natural fertility and organic matter content. The surface layer is slightly acid or neutral, and the subsoil is mildly alkaline or moderately alkaline. The rate of water movement through the soil is moderate, and the available water capacity is medium. The root zone is moderately deep and is favorable for root growth.

Shidler soils make up about 35 percent of the complex. Typically, the surface layer is brown silty clay loam about 12 inches thick. The underlying material is hard, fractured limestone bedrock.

The Shidler soils are high in natural fertility and organic matter content. The soil is mildly alkaline to moderately alkaline. The rate of water movement through the soil is moderate, and the available water capacity is low. The root zone is shallow, and root growth is restricted by the limestone bedrock.

Included in this complex are small areas of Claremore and Lula soils. Also included in some mapped areas are small areas of Rayford soils and Rock outcrop. The included soils and Rock outcrop make up about 10 percent of this map unit. Separate areas of included soils are generally less than 2 acres.

Most of the acreage of these Catoosa and Shidler soils is in rangeland and is used for grazing. The soils of this complex have medium potential for native grasses, and they are best suited to this use. These soils have medium potential for tame pasture. Using these soils as rangeland or tame pasture is effective in controlling erosion. Medium forage yields can be expected with proper management. The quality of native grasses can be improved by controlling brush, proper stocking, controlling grazing, and preventing fires.

The potential for cultivated crops is low. Steepness of slope, shallow depth to bedrock, and Rock outcrop are limitations that are difficult to overcome.

The potential for most urban uses is low. Shallow depth to bedrock, steepness of slope, and Rock outcrop are limitations that are difficult and expensive to overcome.

This complex is in capability subclass VIe. The Catoosa soils are in the Loamy Prairie range site, and Shidler soils are in the Very Shallow range site.

8—Chigley gravelly sandy loam, 1 to 5 percent slopes. This deep, moderately well drained, very gently sloping to gently sloping soil is in the northern half and the south-central part of the county (fig. 1). It formed in material weathered from conglomerate rock. Slopes are complex. Individual areas range from 5 to 30 acres.

Typically, the surface layer is brown, gravelly sandy loam about 6 inches thick. The upper part of the subsoil is yellowish red gravelly clay to a depth of 18 inches. The next layer is red, mottled gravelly clay to a depth of about 26 inches. The next layer is light yellowish brown, mottled gravelly clay to a depth of about 38 inches. The lower part of the subsoil is reddish yellow, mottled clay to a depth of about 54 inches. The underlying material is yellowish brown, mottled gravelly clay to a depth of about 64 inches.

This soil is low in natural fertility and organic matter content. It is medium acid to neutral in the surface layer. The rate of water movement through this soil is moderately slow, and the available water capacity is medium. The root zone is deep and is favorable for root growth. This soil has a perched water table at a depth of 3 to 4 feet during winter and spring.

Included with this soil in mapping are small, scattered areas of Durant soils and small areas of Clarita and Tussy soils. These included soils make up about 10 percent of this map unit. Individual areas generally are less than 1 acre.

This soil is used mainly as tame pasture. A small acreage is used as rangeland.

This soil has low potential for cropland. Management concerns for crops are controlling erosion and maintaining soil tilth and fertility. Adding fertilizer helps to increase plant growth. This provides more crop residue to help maintain soil tilth and fertility. Minimum tillage, terraces, farming on the contour, stripcropping, and using crop residue help to control soil erosion. Winter cover crops furnish additional protection against wind and water erosion.

This soil has medium potential for tame pasture and range. Bermudagrass or weeping lovegrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of the grass. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has medium potential for most urban uses. Moderately slow permeability, high clay content of the subsoil, and shrinking and swelling are the main limitations. These limitations generally can be overcome by proper design or by altering the soil.

This Chigley soil is in capability subclass IVe and in the Sandy Savannah range site.

9—Chigley gravelly sandy loam, 5 to 12 percent slopes. This deep, moderately well drained, sloping to strongly sloping soil is in the northern half and the south-central part of the county. It formed in material weathered from conglomerate rock. Slopes are complex. Individual areas range from 10 to 50 acres.

Typically, the surface layer is dark brown and brown gravelly sandy loam about 6 inches thick. The subsoil is

Figure 1.—Public recreational facilities on Chigley gravelly sandy loam, 1 to 5 percent slopes. This site overlooks Lake of the Arbuckles.

gravelly clay. It is yellowish red to a depth of about 18 inches, red to a depth of about 26 inches, light yellowish brown to a depth of about 38 inches, and brownish yellow to a depth of about 54 inches. The underlying material is light yellowish brown gravelly clay to a depth of about 64 inches.

This soil is low in natural fertility and organic matter content. It is medium acid to neutral in the surface layer and strongly acid to neutral in the upper part of the subsoil. The rate of water movement through this soil is moderately slow, and the available water capacity is medium. The root zone is deep and is favorable for root growth. This soil has a perched water table at a depth of 3 to 4 feet during winter and spring.

Included with this soil in mapping are small areas of soils that have a clay loam or sandy clay loam subsoil. Also included are small areas of Clarita and Tussy soils. These included soils make up about 15 percent of this map unit. Individual areas generally are less than 3 acres.

Areas of this soil are used mainly as tame pasture. A minor acreage is used as rangeland.

This soil has medium potential for tame pasture or native grass, and it is best suited to this use. Rotation grazing, fertilization, weed control, deferred grazing, proper stocking, and preventing fires will help to keep the grass and soil in good condition.

This soil has low potential for cropland. The severe hazard of erosion and strong slopes are limitations that are difficult to overcome. This soil is not suited to cultivated crops. It is better suited to grass.

This soil has medium potential for most urban uses. Moderately slow permeability, high clay content of the subsoil, slope, and shrinking and swelling are the main limitations. These limitations generally can be overcome by proper design or by altering the soil.

This Chigley soil is in capability subclass VIe and in the Sandy Savannah range site.

10—Chigley-Naru complex, 5 to 30 percent slopes. This complex consists of small areas of the Chigley and Naru soils that are so intermingled that they could not be separated at the scale selected for mapping. These soils are on ridgetops and side slopes, mainly in the central part of the county. The complex occurs as large areas of 50 to 200 acres on long, steep side slopes. Individual areas of each soil are 1/2 acre to 3 acres.

Chigley soils make up about 50 percent of the complex. Typically, the surface layer is brown gravelly sandy loam about 3 inches thick. The subsurface layer is light brown gravelly sandy loam to a depth of about 9 inches. The subsoil is gravelly clay loam. It is red to a depth of about 35 inches and yellowish red to a depth of about 46 inches. The upper part of the underlying material is strong brown sandy clay loam to a depth of about 54 inches. The lower part of the underlying material is indurated conglomerate.

Chigley soils are low in natural fertility and medium in organic matter content. The surface layer is medium acid to neutral. The rate of water movement through this soil is moderately slow, and the available water capacity is medium. The root zone is deep and is favorable for root growth. There is a perched water table at a depth of 3 to 4 feet during winter and spring.

Naru soils make up about 35 percent of the complex. Typically, the surface layer is brown cobbly loam about 6 inches thick. The subsurface layer is light brown cobbly loam to a depth of about 15 inches. The subsoil is reddish brown cobbly loam to a depth of about 36 inches. The upper part of the underlying material is coarsely mottled shaly clay to a depth of about 58 inches. The lower part of the underlying material is indurated limestone conglomerate.

Naru soils are medium in natural fertility and organic matter content. They are neutral to moderately alkaline throughout. The rate of water movement through the soil is moderately slow, and the available water capacity is medium. The root zone is deep and is favorable for most root growth.

Included in this complex are small, scattered areas of Grainola soils. Also included in some mapped areas are small areas of Clarita and Rayford soils and areas of Rock outcrop. These included soils and Rock outcrop make up about 15 percent of the complex. Individual areas are generally less than 3 acres.

Most areas of this complex are in range, and the potential is medium for use as rangeland. The vegetation is mostly oak trees and an understory of mid and tall grasses.

Overgrazing thins the grass stand and increases the hazard of water erosion. Moderate forage yields can be expected with proper management. The quality of native grasses can be improved by controlling brush, proper stocking rates, controlling grazing, and preventing fires.

This complex is not suited to cultivated crops and tame pasture; the potential for these uses is low. Slope and the hazard of soil erosion are severe limitations that are difficult to overcome.

This complex has medium potential for woodland wildlife habitat and low potential for recreational use.

This complex has low potential for most urban uses. Slope, moderately slow and slow permeability, wetness, and large stones are severe limitations that are difficult and expensive to overcome.

This complex is in capability subclass VIIe. Both the Chigley and Naru soils are in the Sandy Savannah range site.

11—Chigley-Urban land complex, 2 to 8 percent slopes. Most areas of this complex are on single side slopes, but parts are on ridges. The soils in this complex are in such an intricate pattern with Urban land that it is impractical to separate them. The complex is 60 percent Chigley soils, 30 percent Urban land, and 10 percent Clarita and Durant soils.

Typically, the surface layer of Chigley soils is brown gravelly sandy loam about 6 inches thick. The subsoil is yellowish red gravelly clay to a depth of about 18 inches; red, mottled gravelly clay to a depth of about 26 inches; light yellowish brown, mottled gravelly clay to a depth of about 38 inches; and reddish yellow, mottled clay to a depth of about 54 inches. The underlying material is yellowish brown, mottled gravelly clay to a depth of about 64 inches.

The Chigley soils are low in natural fertility and organic matter content. The surface layer is medium acid to neutral. The rate of water movement through this soil is moderately slow, and the available water capacity is medium. The root zone is deep and is favorable for root growth. This soil has a perched water table at a depth of 3 to 4 feet during the winter and spring.

Urban land consists of areas that are covered primarily by single-unit dwellings, streets, driveways, sidewalks, commercial buildings, and patios.

The more sloping areas of Chigley soils in this complex have been modified by excavating, filling, and grading for building sites and dwellings. This alteration ranges in depth from a few inches to more than a foot, depending on the slope. In excavated and filled areas, the surface layer is a mixture of loamy and clayey materials. Although the thickness of the soil layers differs widely from that described for the Chigley soils, the basic characteristics of the soils remain similar.

Areas of this complex are used primarily for urban development, mainly picnic areas, houses, roads, and streets.

The main concerns in using these soils as urban areas are moderately slow permeability, wetness, slope, shrinking and swelling, small stones, and soil texture. There are severe limitations for septic tank absorption fields, sewage lagoons, and trench sanitary landfills. There are moderate limitations for shallow excavations, dwellings, small commercial buildings, roads and streets, lawns, landscaping, and golf fairways. These soils are well suited to trees, garden plants, shrubs, and flowers.

This complex is not placed in a capability subclass or range site.

12—Chigley and Clarita soils, 2 to 6 percent slopes, gullied. This map unit consists of deep, moderately well drained, very gently sloping to sloping soils on gullied uplands. It occurs throughout the northern and central parts of the county. The soils are on foot slopes or side slopes and have been deeply gullied by water erosion. Areas of each soil are large enough to be mapped separately; but, because of present and predicted use, they were mapped as one unit. About 40 percent of the mapped areas contain both soils; the other areas contain only one soil. On about 50 percent of the acreage, part of the original surface layer has been removed by erosion. On about 30 percent, the original surface layer and material from the upper part of the subsoil have been mixed by tillage. Gullies are 5 to 150 feet apart, 1 to 4 feet deep, and 2 to 15 feet across. Slopes generally are complex. Individual mapped areas range from 5 to 60 acres.

Chigley soil makes up about 45 percent of the map unit. Typically, the surface layer is brown gravelly sandy loam about 5 inches thick. The upper part of the subsoil is reddish brown gravelly clay to a depth of about 17 inches. The middle part is red, mottled clay to a depth of about 34 inches. The lower part of the subsoil is brownish yellow, mottled gravelly clay to a depth of about 48 inches. The underlying material is yellow gravelly silty clay to a depth of about 80 inches.

The Chigley soil is low in natural fertility and organic matter content. The surface layer is medium acid or slightly acid. The rate of water movement through this soil is moderately slow, and the available water capacity is medium. The root zone is deep and is favorable for root growth. This soil has fair tilth and is workable only within a limited range of moisture content.

Clarita soil makes up about 45 percent of the map unit. Typically, the surface layer is dark grayish brown clay about 14 inches thick. The upper part of the subsoil is brown clay to a depth of about 28 inches. The lower part is reddish brown clay to a depth of about 40 inches. The underlying material is yellowish red clay to a depth of about 80 inches.

The Clarita soil is medium in natural fertility and organic matter content. The surface layer is slightly acid to moderately alkaline, and the subsoil is moderately alkaline. The rate of water movement through this soil is very slow, and the available water capacity is high. The root zone is deep and is favorable for root growth. This soil has fair tilth and is workable only within a limited range of moisture content.

Included with these soils in mapping are small scattered areas of Tussy and Durant soils. Also included in some mapped areas, at the lower boundary, are small areas of Bastrop or Burleson soils. These included soils make up about 10 percent of this map unit. Separate areas are generally less than 2 acres.

All areas of these Chigley and Clarita soils have been cultivated in the past. Most areas are presently seeded to grass and are used for tame pasture or range. In some areas where the subsoil is exposed and in areas with sparse vegetation, the surface runoff is rapid. In areas that have a good stand of grass and have been smoothed, the surface runoff is slow.

The potential is low for tame pasture. These soils are best suited to bermudagrass, weeping lovegrass, and other adapted grasses and legumes for pasture.

These soils have low potential for rangeland. Severe erosion has removed much of the original surface layer and lowered natural fertility, but with good management these soils will produce a moderate amount of native grass. Use of these soils for pasture or range is also effective in controlling additional erosion. Overgrazing causes the grass stand to die out. Proper stocking, rotation grazing, and restricted grazing help to keep the grass and soil in good condition.

The potential for cultivated crops is low. These soils should have a permanent grass cover. Gullies and a very severe hazard of erosion are the main limitations. An expensive, major reclamation would be required to make the soils suitable for crops.

These soils have medium potential for most urban uses. Shrinking and swelling, moderately slow and very slow permeability, and a clayey subsoil are significant limitations. Most of these limitations can be overcome by proper design or by altering the soil.

The soils in this map unit are in capability subclass VIe. The Chigley soil is in the Eroded Sandy Savannah range site, and the Clarita soil is in the Eroded Prairie range site.

13—Claremore-Rock outcrop complex, 1 to 5 percent slopes. This complex consists of shallow, well drained Claremore soils and Rock outcrops of limestone that are so intermingled that they could not be separated at the scale selected for mapping. This complex occurs on very gently sloping to gently sloping, low ridges and side slopes of uplands in the northeastern part of the county. Slopes are smooth. Individual areas range from 10 to 70 acres.

Claremore soils make up about 70 percent of the complex. Typically, the surface layer is dark grayish brown loam about 10 inches thick. The subsoil is brown clay loam to a depth of about 18 inches. The underlying bedrock is hard limestone.

Claremore soils are high in natural fertility and organic matter content. The surface layer is neutral, and the subsoil is neutral to moderately alkaline. The rate of water movement through the soil is moderate, and the available water capacity is low. The root zone is shallow, and root growth is restricted by the limestone bedrock.

Rock outcrop makes up about 20 percent of the complex. Typically, it is exposures of bare, hard limestone bedrock. Rock outcrop supports very few plants, and surface runoff is very rapid.

Included with this complex in mapping are small areas of Catoosa soils. Also included are a few small areas of Lula and Shidler soils. These included soils make up about 10 percent of the complex. Separate areas generally are less than 2 acres.

Most areas of this complex are used as rangeland. The Claremore soil has medium potential for growing native grasses. It is best suited to this use. Moderate forage yields can be expected with proper management. The quality of native grasses can be improved by controlling brush, proper stocking, controlling grazing, and preventing fires.

The potential for cropland and tame pasture is low. Shallow depth to bedrock and Rock outcrop are limitations that are difficult to overcome.

The potential is low for most urban uses. Shallow depth to bedrock is a limitation that is difficult and costly to overcome.

The soils of this complex are in capability subclass VIIs. The Claremore soil is in the Loamy Prairie range site. Rock outcrop is not assigned to a range site.

14—Claremore-Urban land complex, 1 to 5 percent slopes. This complex consists of shallow, well drained Claremore soils and areas of Urban land that are so intermingled that they could not be separated at the scale selected for mapping. This complex is 60 percent Claremore soils, 30 percent Urban land, 5 percent Rayford soils, and 5 percent areas of Rock outcrop.

Typically, the surface layer of the Claremore soils is dark grayish brown loam about 10 inches thick. The subsoil, to a depth of about 18 inches, is dark brown clay loam. The underlying material is hard limestone bedrock.

The Claremore soils are high in natural fertility and organic matter content. The surface layer is neutral, and the subsoil is neutral to moderately alkaline. The rate of water movement through the soil is moderate, and the available water capacity is low. The root zone is shallow, and root growth is restricted by the limestone bedrock.

Urban land consists of areas that are covered primarily by single unit dwellings, streets, driveways, sidewalks, commercial buildings, and patios.

The more sloping areas of Claremore soils in this complex have been modified by excavating, filling, and grading for building sites and dwellings. This alteration ranges in depth from a few inches to more than a foot. In excavated and filled areas, the surface layer is a mixture of the surface layer and subsoil. Although the thickness of the soil layers differs widely from those described for the Claremore soils, the basic characteristics of the soils remain similar.

Areas of this complex are used primarily for urban development, mainly picnic areas, houses, and roads and streets.

The main concern in using these soils as urban areas is depth to bedrock. Limitations for septic tank absorption fields, sewage lagoons, sanitary landfills, and roads and streets are severe. Limitations are also severe for shallow excavations, dwellings, small commercial buildings, lawns, landscaping, and golf fairways. The soils are well suited to garden plants, shrubs, and flowers.

The soils of this complex are not placed in a capability subclass or range site.

15—Clarita clay, 2 to 5 percent slopes, eroded. This deep, moderately well drained, very gently sloping to gently sloping, eroded soil is mainly on side slopes of uplands. Areas of this soil are mainly in the northern half of the county, but they do occur in other parts of the county. Rills are common, and a few crossable gullies occur about 200 to 400 feet apart. In about 20 percent of the area, the surface layer and material from the upper part of the subsoil have been mixed by plowing. Slopes are moderately smooth and convex. Individual areas range from 10 to 100 acres.

Typically, the surface layer is brown clay about 8 inches thick. The upper part of the subsoil is brown clay to a depth of about 18 inches. The lower part of the subsoil is reddish brown clay to a depth of about 35 inches. The underlying material is yellowish red, mottled clay to a depth of about 65 inches.

The soil is medium in natural fertility and organic matter content. The surface layer is neutral to moderately alkaline, and the subsoil is moderately alkaline. This soil shrinks and forms wide cracks when it is dry, and it swells when it is wet. The rate of water movement through this soil is very slow, and the available water capacity is high. The root zone is deep and is favorable for root growth. This soil has fair tilth and is workable only within a limited range of moistture content.

Included with this soil in mapping are small, scattered areas of Chigley soils. Also included in some areas are areas of Durant, Rayford, and Tussy soils. These included soils make up about 15 percent of the map unit. Separate areas of included soils are generally less than 2 acres.

Areas of this soil are used mainly as tame pasture. Some acreage is used for range. A minor acreage is cultivated to forage sorghum or small grain.

This soil has medium potential for rangeland and tame pasture. Bermudagrass, weeping lovegrass, and other

Figure 2.—An area of overgrazed native grass is being converted to bermudagrass pasture to increase production. This area is on Clarita clay, 2 to 5 percent slopes.

adapted grasses and legumes are best suited to tame pasture (fig. 2). Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has low potential for cropland. Droughtiness and slope are limitations and are difficult and expensive to overcome.

This soil has low potential for most urban uses. Shrinking and swelling is the main limitation for dwellings, small commercial buildings, and roads and streets. Very slow permeability is a limitation for septic tank absorption fields. Slope is the limiting factor for sewage lagoons. The soil is too clayey for sanitary landfills. Most of the limitations are difficult and expensive to overcome, but proper design or alteration of the soil can overcome some of these limitations.

This Clarita soil is in capability subclass IIIe and in the Blackclay Prairie range site.

16—Clarita clay, 5 to 12 percent slopes, eroded. This deep, moderately well drained, sloping to strongly sloping, eroded soil is mainly on side slopes of uplands. Areas of this soil are located mainly in the northern half of the county, but they do occur in other parts of the county. Rills are common, and a few crossable gullies occur about 100 to 400 feet apart. In about 30 percent of the areas, the surface layer and material from the upper part of the subsoil have been mixed by plowing. Slopes are moderately smooth and convex. Individual areas range from 10 to 100 acres.

Typically, the surface layer is brown clay about 6 inches thick. The subsoil is reddish brown clay to a depth of about 38 inches. The upper part of the underlying material is brown, mottled clay to a depth of about 64 inches. The lower part is yellowish red, mottled clay to a depth of about 80 inches.

This soil is medium in natural fertility and organic matter content. The surface layer is neutral to moderately alkaline, and the subsoil is moderately alkaline. This soil shrinks and develops wide cracks when it is dry, and it swells when it is wet. The rate of water movement through this soil is very slow, and the available water capacity is high. The root zone is deep and is favorable for root growth. This soil has fair tilth and is workable only within a limited range of moisture content.

Included with this soil in mapping are small, scattered areas of Chigley soils. Also included are areas of Durant, Tussy, and Rayford soils. These included soils make up about 15 percent of the map unit. Separate areas of included soils are generally less than 3 acres.

Areas of this soil are used mainly for tame pasture. Some acreage is used for range.

This soil has medium potential for rangeland and tame pasture. Bermudagrass, weeping lovegrass, and other adapted grasses and legumes are best suited to tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The added plant growth also protects the soil from erosion. The quality of native and tame pasture grasses can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has low potential for cropland. Droughtiness and steep slope are limitations and are difficult and expensive to overcome.

This soil has low potential for most urban uses. Shrinking and swelling is the main limitation for dwellings, small commercial buildings, and roads and streets. Very slow permeability is a limitation for septic tank absorption fields. Slope is the limiting factor for sewage lagoons. The soil is clayey, which is a limitation for trench sanitary landfills. Most of the limitations are difficult and expensive to overcome, but proper design or alteration of the soil can overcome some of these limitations.

This Clarita soil is in capability subclass VIe and in the Blackclay Prairie range site.

17—Clarita-Urban land complex, 2 to 12 percent slopes. This complex consists of deep, moderately well drained Clarita soils and areas of Urban land that are so intermingled that they could not be separated at the scale selected for mapping. This complex is 60 percent Clarita soils, 30 percent Urban land, and 10 percent Durant and Chigley soils.

Typically, the surface layer is brown clay about 8 inches thick. Subsoil is clay. It is brown to a depth of about 18 inches and reddish brown to a depth of about 35 inches. The underlying material is yellowish red, mottled clay to a depth of about 65 inches.

The Clarita soil is medium in natural fertility and organic matter content. The surface layer is neutral to moderately alkaline, and the subsoil is moderately alkaline. This soil shrinks and forms wide cracks when it is dry, and it swells when it is wet. The rate of water movement through this soil is very slow, and the available water capacity is high. The root zone is deep and is favorable for root growth.

Urban land consists of areas that are covered mostly by single dwellings, streets, driveways, sidewalks, commercial buildings, and patios.

The more sloping areas of Clarita soils in this complex have been modified by excavating, filling, and grading for building sites and dwellings. This alteration ranges from a few inches to more than a foot, depending on the slope. In excavated and filled areas, the surface layer is a mixture of the surface layer and subsoil. Although the thickness of the soil layers differs widely from those described for the Clarita soil, the basic characteristics of the soils remain similar.

Areas of this complex are used primarily for urban development, mainly picnic areas, houses, and roads and streets.

The main concerns in using these soils as urban areas are very slow permeability, wetness, slope, shrinking and swelling, and soil texture. The limitations for septic tank absorption fields, sewage lagoons, trench sanitary landfills, and roads and streets are severe. Limitations are also severe for shallow excavations, dwellings, small commercial buildings, lawns, landscaping, and golf fairways. These soils are well suited to trees, garden plants, shrubs, and flowers.

The soils of this complex are not placed in a capability subclass or range site.

18—Dale silt loam, rarely flooded. This deep, well drained, nearly level soil is mainly on the flood plain of the Washita River. Areas of this soil are rarely flooded. Individual areas range from 10 to 100 acres.

Typically, the surface layer is dark reddish gray silt loam about 22 inches thick. The subsoil is yellowish red silt loam to a depth of about 46 inches. The underlying material is red silt loam to a depth of about 75 inches.

This soil is high in natural fertility and organic matter content. The surface layer is neutral or mildly alkaline, and the subsoil is mildly alkaline or moderately alkaline. The rate of water movement through the soil is moderate, and the available water capacity is high. The root zone is deep and is favorable for root growth. This soil has good tilth and can be worked throughout a wide range of moisture content.

Included with this soil in mapping are small areas of Yahola, McLain, and Watonga soils. These included soils make up about 15 percent of the map unit. Separate areas of included soils are generally less than 2 acres.

Areas of this soil are mainly cultivated to alfalfa, wheat, cotton, soybeans, or grain sorghum. A minor acreage is used for tame pasture.

This soil has high potential for cropland. Management concerns for crops are maintaining soil tilth and fertility. Adding fertilizer helps to increase plant growth, which provides more crop residue to help maintain soil tilth and fertility.

This soil has high potential for native grass and tame pasture. Bermudagrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has low potential for most urban uses. Flooding, seepage, and shrinking and swelling are the main limitations for sanitary landfills, dwellings, small commercial buildings, septic tank absorption fields, and local roads and streets. Most of the limitations are difficult and costly to overcome, but they can be overcome by proper design or by altering the soil at the site.

This Dale soil is in capability class I and in the Loamy Bottomland range site.

19—Durant loam, 0 to 1 percent slopes. This deep, moderately well drained, nearly level soil is on broad flats, mainly in the eastern half of the county. Slopes are smooth and simple. Individual areas range from 5 to 50 acres.

Typically, the surface layer is dark grayish brown loam about 11 inches thick. The upper part of the subsoil is dark grayish brown clay loam to a depth of about 17 inches. The middle part is brown and grayish brown clay to a depth of about 47 inches. The lower part of the subsoil is light olive brown clay to a depth of about 65 inches.

This soil is high in natural fertility and organic matter content. The surface layer is medium acid or slightly acid, and the subsoil is slightly acid to moderately alkaline. The rate of water movement through the soil is very slow, and the available water capacity is high. The root zone is deep and is favorable for root growth. Tilth is good.

Included with this soil in mapping are small areas of Burleson soils. Also included in some mapped areas, at the upper boundary, are small areas of Lula, Clarita, or Claremore soils. These included soils make up about 10 percent of this map unit. Separate areas of included soils are generally less than 1 acre.

Areas of this soil are used mainly for tame pasture. Some areas are cultivated to forage sorghum and wheat. A minor acreage is used for range.

This soil has high potential for cropland. Management concerns for crops are controlling erosion and maintaining soil tilth and fertility. Adding fertilizer helps to increase plant growth, which provides more crop residue to help maintain soil tilth and fertility. Minimum tillage, farming on the contour, and the use of crop residue help to control soil erosion. Winter cover crops furnish additional soil protection against wind and water erosion.

The soil has high potential for native grass and tame pasture. Bermudagrass or weeping lovegrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The added plant growth helps to protect the soil from erosion. The quality of native and tame pasture grasses can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has low potential for most urban uses. Shrinking and swelling is the main limitation for dwellings, small commercial buildings, and local roads and streets. This soil is too clayey for trench sanitary landfills. Very slow permeability is the main limitation for septic tank absorption fields. Most of these limitations can be overcome by proper design or by altering the soil.

This Durant soil is in capability class I and in the Loamy Prairie range site.

20—Durant loam, 1 to 3 percent slopes. This deep, moderately well drained, very gently sloping soil is on broad flats, mainly in the eastern half of the county. Slopes are smooth and simple. Individual areas range from 10 to 60 acres.

Typically, the surface layer is dark grayish brown loam about 9 inches thick. The upper part of the subsoil is grayish brown clay loam to a depth of about 15 inches. The middle part is grayish brown clay to a depth of about 46 inches. The lower part of the subsoil is brownish yellow mottled clay to a depth of about 64 inches.

This soil is high in natural fertility and organic matter content. The surface layer is medium acid or slightly acid, and the subsoil is slightly acid to moderately alkaline. The rate of water movement through the soil is very slow, and the available water capacity is high. The root zone is deep and is favorable for root growth. Tilth is good.

Included with this soil in mapping are small areas of Burleson soils. Also included in some mapped areas are small areas of Clarita, Lula, or Claremore soils. Occasional rock outcrops are in some areas. These included soils and rock outcrop make up about 10 percent of this map unit. Separate areas of included soils are generally less than 1 acre.

Areas of this soil are used mainly for tame pasture. Some areas are cultivated to forage sorghum and wheat. A minor acreage is used for range.

This Durant soil has high potential for cropland. Management concerns for crops are controlling erosion and maintaining soil tilth and fertility. Adding fertilizer helps to increase plant growth, which provides more crop residue to help maintain soil tilth and fertility. Minimum tillage, terraces, farming on the contour, stripcropping, and using crop residue help to control soil erosion. Winter cover crops furnish additional soil protection against wind and water erosion.

The soil has high potential for native grass and tame pasture. Bermudagrass or weeping lovegrass and clovers are commonly used in tame pasture. A minor acreage of plains bluestem grass is being used as tame pasture in some areas. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has low potential for most urban uses. Shrinking and swelling is the main limitation for dwellings, small commercial buildings, and local roads and streets. This soil is clayey, which is a limitation, for trench sanitary landfills. Very slow permeability is the main limitation for septic tank absorption fields. Most of the limitations can be overcome, however, by proper design or by altering the soil.

This Durant soil is in capability subclass IIe and in the Loamy Prairie range site.

21—Durant loam, 2 to 5 percent slopes, eroded. This deep, moderately well drained, very gently sloping or gently sloping soil is on smooth ridges, mainly in the eastern half of the county. This eroded upland soil has many rills and a few small gullies in most areas. The surface layer has been thinned by erosion, and the subsoil has been exposed by plowing over about 50 percent of the area. Slopes are simple. Individual areas range from 5 to 75 acres.

Typically, the surface layer is dark grayish brown loam about 7 inches thick. The subsoil is clay. It is dark grayish brown to a depth of about 17 inches, grayish brown to a depth of about 45 inches, and light olive brown to a depth of about 75 inches.

This soil is high in natural fertility and low in organic matter content. The surface layer is medium acid or slightly acid, and the subsoil is slightly acid to moderately alkaline. The rate of water movement through the soil is very slow, and the available water capacity is high. The root zone is deep and is favorable for root growth. Tilth is fair.

Included with this soil in mapping are small areas of Clarita soils. Also included, in some mapped areas, are small areas of Lula, Chigley, and Fitzhugh soils. These included soils make up about 10 percent of this map unit. Separate areas of included soils are generally less than 2 acres.

Areas of this Durant soil are used mainly for tame pasture. Some areas are seeded to native grasses. A minor acreage is cultivated to forage sorghum.

This soil has moderate potential for cropland. The hazard of erosion is severe if cultivated crops are grown. This soil is best suited to grass. Management concerns for crops are controlling erosion and maintaining soil tilth and fertility. Adding fertilizer helps to increase plant growth, which provides more crop residue to help maintain soil tilth and fertility. Minimum tillage, terraces, farming on the contour, stripcropping, and using crop residue help to control soil erosion. Winter cover crops furnish additional soil protection against wind and water erosion.

The soil has medium potential for native grass and tame pasture. Bermudagrass or weeping lovegrass and clovers are commonly used in tame pasture. A minor acreage of plains bluestem grass is also being used as tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The added plant growth helps to protect the soil from erosion. The quality of native and tame pasture grasses can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has low potential for most urban uses. Shrinking and swelling is the main limitation for dwellings, small commercial buildings, and local roads and streets. This soil is too clayey for trench sanitary landfills. Very slow permeability is the main limitation for septic tank absorption fields. Most of the limitations can be overcome, however, by proper design or by altering the soil.

This Durant soil is in capability subclass IVe and in the Loamy Prairie range site.

22—Durant loam, 2 to 5 percent slopes, gullied. This deep, moderately well drained, very gently sloping or gently sloping soil is on side slopes of uplands throughout the eastern half of the county. This soil occurs between gullies. Areas of this soil have been cultivated in the past, and very severe water erosion has removed much of the original surface layer and formed many gullies. Some of the gullies are crossable by farm machinery. The gullies make up less than 10 percent of each mapped area. The gullies are 6 inches to 5 feet deep, 2 to 8 feet wide, and from 25 to 100 feet apart.

Typically, the surface layer is dark grayish brown loam about 14 inches thick. The upper part of the subsoil is brown clay loam to a depth of about 18 inches. The middle part of the subsoil is light olive brown clay to a depth of about 50 inches. The lower part of the subsoil is olive yellow clay to a depth of about 70 inches.

This soil is high in natural fertility and low in organic matter content. The surface layer is medium acid or slightly acid, and the subsoil is slightly acid to moderately alkaline. The rate of water movement through the soil is very slow, and the available water capacity is high. The root zone is deep and is favorable for root growth. Tilth is fair.

Included with this soil in mapping are small areas of Clarita soils. Also included in some mapped areas are small areas of Renfrow and Chigley soils. These included soils make up about 5 percent of this map unit. Separate areas of included soils are generally less than 1 acre.

Areas of this Durant soil are used mainly for tame pasture. Some areas are seeded to native grasses.

This soil has low potential for cultivated crops. It should have a permanent grass cover. A very severe hazard of erosion and the gullies are the main limitations. An expensive, major reclamation of the soil would be required to make it suitable for crops.

This soil has medium to low potential for native grass and tame pasture. Bermudagrass or weeping lovegrass and clovers are commonly used in tame pasture. A minor acreage of plains bluestem grass is also being used as tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has low potential for most urban uses. Shrinking and swelling is the main limitation for dwellings, small commercial buildings, and local roads and streets. This soil is too clayey for trench sanitary landfills. Very slow permeability is the main limitation for septic tank absorption fields. Most of the limitations can be overcome, however, by proper design or by altering the soil.

This Durant soil is in capability subclass VIe and in the Eroded Prairie range site.

23—Durant-Urban land complex, 0 to 5 percent slopes. The soils in this complex are on single side slopes and broad flats. The soils and areas of Urban land occur in such an intricate pattern that it is impractical to separate them. This complex is 55 percent Durant soils, 35 percent Urban land, and 10 percent Clarita soils.

Typically, the surface layer of the Durant soils is dark grayish brown loam about 9 inches thick. The upper part of the subsoil is grayish brown clay loam to a depth of about 15 inches. The middle part is grayish brown clay to a depth of about 46 inches. The lower part of the subsoil is brownish yellow clay to a depth of about 64 inches.

The Durant soils are high in natural fertility and organic matter content. The surface layer is medium acid or slightly acid, and the subsoil is slightly acid to moderately alkaline. The rate of water movement through the soil is very slow, and the available water capacity is high. The root zone is deep and is favorable for root growth.

Urban land consists of areas that are covered mostly by single unit dwellings, streets, driveways, sidewalks, commercial buildings, and patios.

The more sloping areas of Durant soils in this complex have been modified by excavating, filling, and grading for building sites and dwellings. This alteration ranges in depth from a few inches to more than a foot, depending on the slope. In excavated and filled areas, the surface layer is a mixture of loamy and clayey material. Although the thickness of the soil layers differs widely from those described for the Durant soils, the basic characteristics of the soils are similar.

The soils in this complex are used mostly for urban development, mainly picnic areas, playground areas, houses, and roads and streets.

The main concerns in using these soils as urban areas are very slow permeability, slope, and shrinking and swelling. The soils have slight limitations for area sanitary landfills, lawns and landscaping, and golf fairways. They have moderate limitations for sewage lagoons and shallow excavations. The soils have severe limitations for septic tank absorption fields, trench type sanitary landfills, dwellings, small commercial buildings, and local roads and streets. They are poorly suited to uncoated steel and moderately suited to concrete. Most of the limitations can be overcome by proper design or by altering the soil. These soils are well suited to trees, garden plants, shrubs, and flowers.

This complex is not placed in a capability subclass or range site.

24—Elandco silt loam, occasionally flooded. This deep, well drained, nearly level soil is on flood plains of small streams throughout the county. It is level to concave and is occasionally flooded. Individual areas range from 10 to 60 acres.

Typically, the surface layer is dark grayish brown silt loam about 21 inches thick. The next layer is brown silty clay loam to a depth of about 58 inches. The underlying material is yellowish brown silty clay loam to a depth of about 75 inches.

This soil is high in natural fertility and organic matter content. The surface layer is neutral or mildly alkaline, and below the surface layer the soil is mildly alkaline or moderately alkaline. The rate of water movement through the soil is moderate, and the available water capacity is high. The root zone is deep and is favorable for root growth. This soil has good tilth and can be worked throughout a wide range of moisture content.

Included with this soil in mapping are small areas of Garvin soils. The included soils make up about 5 percent of the map unit. Separate areas are generally less than 1 acre.

Areas of this Elandco soil are mainly cultivated to wheat, alfalfa, or grain sorghum. A minor acreage is used for tame pasture.

This soil has high potential for cropland. Management concerns for crops are maintaining soil tilth and fertility. Adding fertilizer helps to increase plant growth, which provides more crop residue to help maintain soil tilth and fertility.

This soil has high potential for range and tame pasture. Bermudagrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has low potential for most urban uses. Flooding is the main limitation that restricts its use for sanitary landfills, dwellings, small commercial buildings, septic tank absorption fields, sewage lagoons, and local roads and streets. This limitation is difficult and costly to overcome.

This Elandco soil is in capability subclass IIw and in the Loamy Bottomland range site.

25—Eufaula loamy fine sand, undulating. This deep, well drained, undulating to hummocky soil occurs near the Washita River. Slopes are complex and range from 3 to 8 percent. Individual areas range from 5 to 25 acres.

Typically, the surface layer is pale brown and brown loamy fine sand about 10 inches thick. The subsurface layer is light yellowish brown loamy fine sand to a depth of about 36 inches. The subsoil to a depth of 80 inches is pink fine sand with a thin layer of yellowish red loamy fine sand.

This soil is moderate in natural fertility and low in organic matter content. The surface layer and subsoil are slightly acid or neutral. The rate of water movement through this soil is rapid, and the available water capacity is very low. The root zone is deep and is favorable for root growth.

Included with this soil in mapping are small areas of Konawa soils. Also included in some mapped areas are Teller soils. These included soils make up about 15 percent of this map unit. Separate areas of included soils are generally less than 1 acre.

Areas of this Eufaula soil are used mainly for tame pasture. Some areas are used for range.

This soil has medium potential for tame pasture and range. Bermudagrass or weeping lovegrass are commonly used in tame pasture. The native vegetation is mostly tall grasses, post oak, and blackjack oak. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The added plant growth protects the soil from erosion. The quality of tame pasture and range grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has low potential for crops and medium potential for most urban uses. The soil is too sandy for sewage lagoons and sanitary landfills. Seepage is also a limitation. These limitations are costly and difficult to overcome.

This Eufaula soil is in capability subclass VIe and in the Deep Sand Savannah range site.

26—Fitzhugh loam, 1 to 3 percent slopes. This deep, well drained, very gently sloping soil is on broad flats, mainly in the northeastern part of the county. Slopes are convex. Individual areas range from 5 to 50 acres.

Typically, the surface layer is brown loam about 14 inches thick. The upper part of the subsoil is yellowish brown clay loam to a depth of about 18 inches. The middle part is reddish brown clay loam to a depth of about 40 inches. The lower part of the subsoil is red sandy clay loam to a depth of about 54 inches. The underlying material is alternating layers of sandstone and sandy shale to a depth of about 60 inches.

This soil is high in natural fertility and organic matter content. The surface layer is slightly acid, and the subsoil is slightly acid or neutral. The rate of water movement through this soil is moderate, and the available water capacity is high. The root zone is deep and is favorable for root growth. This soil has good tilth and can be worked throughout a wide range of moisture content.

Included with this soil in mapping are small, scattered areas of Durant soils. Also included in some mapped areas are small areas of Lula and Stephenville Variant soils. These included soils make up about 5 percent of the map unit. Separate areas of included soils are generally less than 1 acre.

Areas of this Fitzhugh soil are used mainly for tame pasture. Some areas are cultivated to wheat, grain sorghums, and soybeans. A minor acreage is used for range.

This Fitzhugh soil has high potential for cropland. Management concerns for crops are controlling erosion and maintaining soil tilth and fertility. Adding fertilizer helps to increase plant growth, which provides more crop residue to help maintain soil tilth and fertility. Minimum tillage, terraces, farming on the contour, stripcropping, and using crop residue help to control soil erosion. Winter cover crops furnish additional soil protection against wind and water erosion.

This soil has high potential for native grass and tame pasture. Bermudagrass or sand lovegrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The added plant growth helps to protect the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has medium to high potential for most urban uses. Depth to rock and moderate permeability are the main limitations for sanitary landfills, sewage lagoons, and septic tank absorption fields. There are no limitations for dwellings and shallow excavations. Seepage and slope limit the use of this soil for sewage lagoons. Most of these limitations can be overcome by proper design or by altering the soil.

This Fitzhugh soil is in capability subclass IIe and in the Loamy Prairie range site.

27—Fitzhugh loam, 2 to 5 percent slopes, eroded. This deep, well drained, very gently sloping to gently sloping soil occurs mainly in the northeastern part of the county. This map unit is marred by sheet erosion and occasional gullies 1/2 foot to 3 feet deep, 2 to 8 feet wide, and approximately 100 to 200 feet apart. The soil formed in material weathered from interbedded sandstone and shale. Slopes are convex. Individual areas are 5 to 40 acres.

Typically, the surface layer is dark brown loam about 6 inches thick. The upper part of the subsoil is brown clay loam to a depth of about 10 inches. The middle part is reddish brown clay loam to a depth of about 24 inches. The lower part of the subsoil is red clay loam to a depth of about 42 inches. The underlying material is alternating layers of sandstone and sandy shale.

This soil is high in natural fertility and organic matter content. It is medium acid to neutral. The rate of water movement through this soil is moderate, and the available water capacity is high. The root zone is deep and is favorable for root growth.

Included with this soil in mapping are small, scattered areas of Durant soils. Also included in some mapped areas are small areas of Stephenville Variant and Lula soils. These included soils make up about 5 percent of this map unit. Separate areas of included soils are generally less than 2 acres.

Areas of the Fitzhugh soil are used mainly for tame pasture. Some areas are cultivated to wheat, soybeans, and grain sorghum. A minor acreage is used for range.

This soil has medium potential for cropland. Management concerns for crops are controlling erosion and maintaining soil tilth and fertility. Adding fertilizer helps to increase plant growth, which provides more crop residue to help maintain soil tilth and fertility. Minimum tillage, terraces, farming on the contour, stripcropping, and using crop residue help to control soil erosion. Winter cover crops furnish additional soil protection against wind and water erosion.

The soil has high potential for native grass and tame pasture. Bermudagrass or sand lovegrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

The soil has medium potential for most urban uses. Depth to rock, slope, and moderate permeability are the main limitations for sanitary landfills, sewage lagoons, and septic tank absorption fields. Seepage also limits the use of this soil for sewage lagoons. There are no limitations for dwellings and shallow excavations. Most of the limitations can be overcome by proper design or by altering the soil.

This Fitzhugh soil is in capability subclass IIIe and in the Loamy Prairie range site.

28—Fitzhugh loam, 2 to 5 percent slopes, gullied. This deep, well drained, very gently sloping or gently sloping, gullied soil occurs mainly in the northeastern part of the county. It is mainly on side slopes. About 50 percent of the acreage has had part of the original surface layer removed by erosion. On about 25 percent, the original surface layer and material from the upper part of the subsoil have been mixed by tillage. Gullies are 1/2 foot to 4 feet deep, 2 to 10 feet wide, and approximately 25 to 75 feet apart. Slopes are convex. Individual areas are 5 to 30 acres.

Typically, the surface layer is brown loam about 4 inches thick. The upper part of the subsoil is brown clay loam to a depth of about 14 inches. The middle part is reddish brown clay loam to a depth of about 35 inches. The lower part of the subsoil is reddish brown sandy clay loam to a depth of about 45 inches. The underlying material is alternating layers of interbedded sandstone and sandy shale.

This soil is high in natural fertility and low in organic matter content. It is medium acid to neutral. The rate of water movement through this soil is moderate, and the available water capacity is high. The root zone is deep and is favorable for root growth.

Included with this soil in mapping are small areas of Durant soils. Also included in some mapped areas are small, intermingled areas of Stephenville Variant soils. These included soils make up about 10 percent of this map unit. Separate areas of included soils are generally less than 2 acres. Gullies make up about 10 percent of the map unit.

All areas of this Fitzhugh soil have been cultivated in the past. Most areas are presently seeded to grass and are used for tame pasture or range.

This soil has medium potential for native grass and tame pasture. Bermudagrass or sand lovegrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires. Low fertility and a very severe erosion hazard are the main limitations.

This soil has very low potential for cropland because of the uncrossable gullies. Extensive cutting and filling would be required to reclaim this soil for cropland. The erosion hazard is very severe.

This soil has medium potential for most urban uses. Depth to rock, slope, and moderate permeability are the main limitations for sanitary landfills, sewage lagoons, and septic tank absorption fields. Seepage also limits the use of this soil for lagoons. There are no limitations for dwellings and shallow excavations. Most of the limitations can be overcome by proper design or by altering the soil.

This Fitzhugh soil is in capability subclass VIe and in the Eroded Prairie range site.

29—Garvin silty clay, occasionally flooded. This deep, moderately well drained, very slowly permeable soil is on narrow, long flood plains throughout the county. It is nearly level to concave. Slopes are 0 to 1 percent. Individual areas range from 5 to 50 acres.

Typically, the surface layer is dark grayish brown silty clay about 6 inches thick. The next layer is dark gray silty clay to a depth of about 22 inches. The subsoil is reddish brown silty clay to a depth of about 42 inches. The underlying material is reddish brown silty clay to a depth of about 80 inches.

This soil is high in natural fertility and organic matter content. The surface layer is neutral to moderately alkaline, and the subsoil is moderately alkaline. The rate of water movement through the soil is very slow, and the available water capacity is high. The root zone is deep and is favorable for root growth.

Included with this soil in mapping are small areas of Elandco soils and occasional small areas of a soil that is high in sodium content. The included soils make up about 5 percent of this map unit. Individual areas of included soils generally are less than 1 acre.

Most areas of this Garvin soil are cultivated or used for tame pasture. Small grains and alfalfa are the main cultivated crops.

This soil has high potential for cropland. Management concerns for crops are maintaining soil tilth and fertility. Adding fertilizer helps to increase plant growth, which provides more crop residue to help maintain soil tilth and fertility. Minimum tillage, winter cover crops, and returning crop residue to the soil improve fertility, reduce crusting, and increase water infiltration.

This soil has high potential for range and tame pasture. Bermudagrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires. Proper stocking, rotation grazing, timely deferment of grazing and restricted use during wet periods help to keep the grass and soil in good condition.

This soil has low potential for most urban uses. Very slow permeability, clay content, flooding, and shrinking and swelling are the main limitations that restrict its use for septic tank absorption fields, sanitary landfills, dwellings, small commercial buidings, and roads and streets. Most of these limitations are difficult and expensive to overcome, but they can be overcome by proper design or by altering the soil at the site.

This Garvin soil is in capability subclass IIIw and in the Heavy Bottomland range site.

30—Garvin and Elandco soils, frequently flooded. This map unit consists of deep, moderately well drained Garvin soils and deep, well drained Elandco soils. These soils are on narrow flood plains throughout the county. They are nearly level; slopes are 0 to 1 percent. Areas of each soil are large enough to be mapped separately, but because of present land use they were mapped as one unit. About 40 percent of the mapped areas contain both soils; the other areas contain only one of the soils. Individual mapped areas range from 5 to 30 acres and are from 50 to 300 feet wide, including the creek channel.

Garvin soils make up about 60 percent of the map unit. Typically, the surface layer is dark grayish brown silty clay about 22 inches thick. The subsoil is brown silty clay to a depth of about 48 inches. The underlying material is strong brown silty clay loam to a depth of about 75 inches.

The Garvin soils are high in natural fertility and organic matter content. The surface layer is neutral to moderately alkaline, and the subsoil is moderately alkaline. The rate of water movement through the soil is very slow, and the available water capacity is high. The root zone is deep and is favorable for root growth.

Elandco soils make up about 30 percent of the map unit. Typically, the surface layer is brown silt loam about 10 inches thick. The next layer is dark grayish brown silty clay loam to a depth of about 23 inches. The next layer is brown silty clay loam to a depth of about 34 inches. The underlying material is dark grayish brown silty clay loam that has thin strata of silt loam to a depth of about 75 inches.

The Elandco soils are high in natural fertility and organic matter content. The surface layer is slightly acid to mildly alkaline, and the soil is mildly alkaline to moderately alkaline below. The rate of water movement through the soil is moderate, and the available water capacity is high. The root zone is deep and is favorable for root growth.

Included with these soils in mapping are small areas of Bastrop, Chigley, and Clarita soils. The included soils make up about 10 percent of the map unit. Separate areas of included soils are generally less than 1 acre.

Areas of these Garvin and Elandco soils are used mainly for tame pasture, where trees have been removed. Where the adjacent soils are cultivated, minor acreage is cultivated to crops.

These soils have high potential for range and tame pasture. Bermudagrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

These soils have low potential for cropland. Flooding is the main limitation.

These soils have low potential for most urban uses. Flooding is the main limitation that restricts their use for septic tank absorption fields, sanitary landfills, dwellings, small commercial buildings, and roads and streets. This limitation is difficult and expensive to overcome.

The soils of this map unit are in capability subclass Vw. The Garvin soils are in the Heavy Bottomland range site, and the Elandco soils are in the Loamy Bottomland range site.

31—Gasil sandy loam, 2 to 5 percent slopes, eroded. This deep, well drained, very gently sloping or gently sloping, eroded soil occurs mainly in the southeastern part of the county. Rills are common between small crossable gullies that are about 100 to 200 feet apart. In about 45 percent of the area, the surface layer and material from the upper part of the subsoil have been mixed by plowing. Slopes are generally smooth and convex. Individual areas range from 5 to 40 acres.

Typically, the surface layer is brown sandy loam about 7 inches thick. The upper part of the subsoil is brown sandy clay loam to a depth of about 14 inches. The middle part is reddish yellow, mottled sandy clay loam to a depth of about 44 inches. The lower part of the subsoil is reddish yellow fine sandy loam to a depth of about 72 inches.

This soil is low in natural fertility and organic matter content. The surface layer is neutral or slightly acid, and the subsoil is strongly acid to slightly acid. The rate of water movement through the soil is moderate, and the available water capacity is high. The root zone is deep and is favorable for root growth.

Included with this soil in mapping are small areas of Stephenville Variant soils. Also included in some mapped areas are small areas of sandstone rock outcrops. Included in most mapped areas are areas of Konsil soils.

These included soils make up about 5 percent of the map unit. Separate areas of included soils are generally less than 1 acre.

Areas of this Gasil soil are used mainly for tame pasture. A minor acreage is used for range.

The soil has medium potential for cropland. Management is needed to protect the soil against further rill and gully erosion and to maintain or improve soil tilth and fertility. Adding fertilizer helps to increase plant growth, which provides more crop residue to help maintain soil tilth and fertility. Minimum tillage, terraces, farming on the contour, stripcropping, and using crop residue help to control soil erosion. Winter cover crops furnish additional soil protection against wind and water erosion.

The soil has medium potential for native grass and tame pasture. Bermudagrass or weeping lovegrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has medium potential for most urban uses. There are no significant limitations for sanitary landfills, shallow excavations, dwellings, and lawns. Moderate permeability is the main limitation for septic tank absorption fields. Seepage and slope are the main limitations for sewage lagoons. Slope is the main limitation for small commercial buildings. Most of these limitations can be overcome by proper design or by altering the soil.

This Gasil soil is in capability subclass IVe and in the Sandy Savannah range site.

32—Gasil sandy loam, 2 to 5 percent slopes, gullied. This deep, well drained, very gently sloping or gently sloping soil is on side slopes of uplands in the southeastern part of the county. Slopes are commonly smooth and convex. Individual areas range from 5 to 30 acres. This soil occurs between gullies. Areas of this soil have been cultivated, and very severe water erosion has removed much of the original surface layer and formed gullies. Some of the gullies are crossable by farm machinery. The gullies make up less than 10 percent of each mapped area. The gullies are 1 to 8 feet deep, 2 to 12 feet wide, and from 10 to 100 feet apart.

Typically, the surface layer is brown sandy loam about 4 inches thick. The upper part of the subsoil is brown sandy clay loam to a depth of about 16 inches. The lower part of the subsoil is reddish yellow sandy clay loam to a depth of about 72 inches. The underlying material is weakly consolidated sandstone or packsand to a depth of about 80 inches.

This soil is low in natural fertility and organic matter content. The surface layer is slightly acid or neutral, and the subsoil is strongly acid to slightly acid. The rate of water movement through the soil is moderate, and the available water capacity is high. The root zone is deep and is favorable for root growth.

Included with this soil in mapping are small areas of Stephenville Variant soils. Also included in some mapped areas are small areas of sandstone rock outcrops and Durant soils. Also included in most mapped areas are areas of Konsil soils. These included soils make up about 5 percent of the map unit. Separate areas of included soils are generally less than 1 acre.

Areas of this soil are used mainly for tame pasture. Some areas have been reseeded to native grasses and are used for range.

This soil has very low potential for cropland; it should have a permanent grass cover. A very severe hazard of erosion and the gullies are the main limitations. An expensive major reclamation of the soil would be required to make it suitable for crops.

The soil has medium to low potential for native grass and tame pasture. Bermudagrass or weeping lovegrass and clovers are commonly used in tame pastures. Fertilizing tame pasture increases the amount of forage and improves the vigor of the grass stand. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has medium potential for most urban uses. There are no significant limitations for sanitary landfills, shallow excavations, dwellings, and lawns. Moderate permeability is the main limitation for septic tank absorption fields. Seepage and slope are the main limitations for sewage lagoons. Slope is the main limitation for small commercial buildings. Most of these limitations can be overcome by proper design or by altering the soil.

This Gasil soil is in capability subclass VIe and in the Eroded Sandy Savannah range site.

33—Gasil fine sandy loam, 1 to 3 percent slopes. This deep, well drained, very gently sloping soil is on ridgetops of uplands in the southeastern part of the county. Slopes are generally smooth and convex. Individual areas range from 5 to 80 acres.

Typically, the surface layer is brown fine sandy loam about 16 inches thick. The upper part of the subsoil is light brown sandy clay loam to a depth of about 20 inches. The lower part of the subsoil is reddish yellow, mottled sandy clay loam to a depth of about 80 inches.

This soil is low in natural fertility and organic matter content. The surface layer is medium acid to neutral, and the subsoil is strongly acid to slightly acid. The rate of water movement through the soil is moderate, and the available water capacity is high. The root zone is deep and is favorable for root growth.

Included with this soil in mapping are small areas of Burleson and Durant soils. These included soils make up about 5 percent of the map unit. Separate areas of included soils are generally less than 2 acres.

Areas of this Gasil soil are used mainly for tame pasture. Some areas are cultivated to grain sorghums, wheat, and soybeans. A minor acreage is used for range.

The soil has moderate to high potential for cropland. Management concerns for crops are controlling erosion and maintaining soil tilth and fertility. Adding fertilizer helps increase plant growth, which provides more crop residue to help maintain soil tilth and fertility. Minimum tillage, terracing, farming on the contour, stripcropping, and using crop residue help to control soil erosion. Winter cover crops furnish additional soil protection against wind and water erosion.

The soil has high potential for native grass and tame pasture. Bermudagrass or weeping lovegrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has medium to high potential for most urban uses. There are no significant limitations for sanitary landfills, shallow excavations, dwellings, and lawns. Moderate permeability is the main limitation for septic tank absorption fields. Seepage and slope are the main limitations for sewage lagoons. Slope is the main limitation for small commercial buildings. Most of these limitations can be overcome by proper design or by altering the soil.

This Gasil soil is in capability subclass IIe and in the Sandy Savannah range site.

34—Gasil Variant shaly silt loam, 2 to 5 percent slopes. This deep, well drained, very gently sloping to gently sloping soil is in the south-central part of the county on foot slopes below higher ridges adjacent to the Arbuckle Mountains. Slopes are complex. Individual areas range from 5 to 50 acres.

Typically, the surface layer is light brownish gray shaly silt loam about 3 inches thick. The subsurface layer is light brown shaly silt loam to a depth of about 13 inches. The upper part of the subsoil is reddish yellow very shaly silty clay loam to a depth of about 26 inches. The middle part is red very shaly silt loam to a depth of about 40 inches. The lower part of the subsoil is red silty clay loam to depth of about 65 inches. The underlying material is red silty clay loam to a depth of about 75 inches.

This soil is low in natural fertility and organic matter content. The surface layer is medium acid or slightly acid, and the subsoil is very strongly acid or strongly acid. The rate of water movement through the soil is moderate, and the available water capacity is medium. The root zone is deep and is favorable for most growth.

Included with this soil in mapping is a similar soil that has a gravelly loam surface layer. This included soil makes up about 15 percent of this map unit. Separate areas of the included soil are generally less than 2 acres.

Areas of this Gasil Variant soil are used mainly for range. A minor acreage is in tame pasture.

This soil has medium potential for cropland. Management concerns for crops are controlling erosion and maintaining soil tilth and fertility. Adding fertilizer helps to increase plant growth, which provides more crop residue to help maintain soil tilth and fertility. Minimum tillage, terracing, farming on the contour, stripcropping, and using crop residue help to control soil erosion. Winter cover crops furnish additional soil protection against wind and water erosion.

The soil has high to medium potential for native grass and tame pasture. Bermudagrass or weeping lovegrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has medium potential for most urban uses. Shrinking and swelling and large stones are the main limitations for dwellings, small commercial buildings, and roads and streets. Moderate permeability and large stones are the limiting factors for septic tank absorption fields. Seepage, slope, and large stones are limitations for sewage lagoons. Large stones and a subsoil that is too clayey are limitations for trench sanitary landfills. Most of these limitations can be overcome by proper design or by altering the soil.

This Gasil Variant soil is in capability subclass IIIe and in the Sandy Savannah range site.

35—Grainola cobbly clay loam, 5 to 20 percent slopes, eroded. This moderately deep, well drained, sloping to moderately steep soil occurs mainly south and west of Davis on foot slopes adjacent to the Arbuckle Mountains. Slopes are complex. Individual areas range from 10 to 40 acres.

Typically, the surface layer is reddish brown cobbly clay loam about 8 inches thick. The subsoil is red clay to a depth of about 28 inches. The underlying material is red shaly clay to a depth of about 60 inches.

This soil is medium in natural fertility and low in organic matter content. It is moderately alkaline throughout. The rate of water movement through the soil is very slow, and the available water capacity is low. The root zone is moderately deep and is favorable for most root growth.

Included with this soil in mapping are small, scattered areas of Renfrow soils. Also included in some mapped areas are small areas of Kiti, Kingfisher Variant, and

Rayford soils. These included soils make up about 15 percent of this map unit. Separate areas of included soils are generally less than 1 acre.

Areas of this Grainola soil are used mainly for range.

This soil has medium potential for growing native grasses. Moderate yields can be expected with proper management. The quality of native grasses can be improved by controlling brush, proper stocking, controlling grazing, and preventing fires.

The potential for cropland and tame pasture is low. Depth to rock, steepness of slope, and very slow permeability are limitations that are difficult and expensive to overcome.

The potential for most urban uses is low. Depth to bedrock, large stones, steepness of slope, and shrinking and swelling are limitations that are difficult and expensive to overcome.

This Grainola soil is in capability subclass VIIs and in the Shallow Prairie range site.

36—Kingfisher Variant-Rock outcrop complex, 2 to 6 percent slopes. This complex consists of moderately deep, well drained, Kingfisher Variant soils on uplands and rows of limestone Rock outcrops that are so intermingled that they could not be separated at the scale selected for mapping. The Kingfisher Variant soils occur between the rows of limestone Rock outcrops. This complex is on broad, very gently sloping to sloping ridgetops of the Arbuckle Mountains south and west of Sulphur. Slopes are complex. Individual areas range from 10 to 200 acres.

Kingfisher Variant soils make up about 60 percent of the complex. Typically, the surface layer is dark brown silt loam about 12 inches thick. The subsoil is reddish brown silty clay loam to a depth of about 35 inches. The underlying material, to a depth of about 40 inches, is hard fractured limestone that is tilted 60 degrees from horizontal.

Kingfisher Variant soils are high in natural fertility and organic matter content. The surface layer is medium acid or slightly acid, and the subsoil is medium acid to neutral. The rate of water movement through this soil is moderate, and the available water capacity is medium. The root zone is moderately deep and is favorable for root growth to the underlying bedrock.

Rock outcrop of limestone makes up about 25 percent of the complex. Typically, it consists of rows of limestone Rock outcrop that are turned on edge at an angle of about 60 degrees. These rows of limestone Rock outcrop are about 5 to 10 inches thick and extend from a few inches to 3 feet above the soil surface. In some areas the limestone Rock outcrops give the appearance of rows of gravestones.

Included in this complex are small areas of Kiti and Norge Variant soils. Kiti and Norge Variant soils are on similar landscapes. Kiti soils are less than 20 inches thick over limestone, and the Norge Variant soils are more than 40 inches thick over limestone. These inclusions make up about 15 percent of this complex. Separate areas of included soils are generally less than 2 acres.

Most areas of this complex are used as rangeland. A minor acreage is used for tame pasture.

This complex has medium potential for growing native grasses and is best suited to this use. Moderate to high forage yields can be expected with proper management. The quality of native grasses can be improved by controlling brush, proper stocking, controlling grazing, and preventing fires.

The potential is low for cropland and medium for tame pasture. Soil depth and rock outcrops are limitations that are difficult to overcome.

The potential for most urban uses is low. Depth to bedrock and rock outcrops of hard limestone are limitations that are difficult and expensive to overcome.

This complex is in capability subclass VIIs. Kingfisher Variant soils are in the Loamy Prairie range site. The Rock outcrop part is not assigned to a range site.

37—Kiti-Rock outcrop complex, 2 to 8 percent slopes. This complex consists of very shallow and shallow, well drained, very gently sloping to sloping Kiti soil on uplands and Rock outcrops of limestone that are so intermingled that they could not be separated at the scale selected for mapping. This complex is on broad, convex ridgetops and side slopes of the Arbuckle Mountains. The Kiti soil occurs between the rows of limestone Rock outcrop. Slopes are complex. Individual mapped areas range from 40 to 600 acres.

Kiti soil makes up about 60 percent of the complex. Typically, the surface layer is dark grayish brown very flaggy loam about 6 inches thick. The next layer is dark grayish brown very flaggy loam to a depth of about 14 inches. The underlying material is hard, fractured limestone that is tilted 45 degrees from horizontal.

This Kiti soil is high in natural fertility and organic matter content. It is mildly alkaline or moderately alkaline. The rate of water movement through the soil is moderate, and the available water capacity is very low. The root zone is very shallow and shallow, and root growth is restricted by the limestone bedrock.

Rock outcrop makes up about 30 percent of the complex. Typically, it consists of almost vertical Rock outcrops of limestone that are tilted at about a 45 degree angle. The strata are about 5 to 15 inches thick, are 3 inches to 3 feet high, and appear as long, narrow rows of edgerock.

Included in this complex are small areas of Kingfisher Variant soils. Also included in some mapped areas are small areas of Rayford and Norge Variant soils. These included soils make up about 10 percent of this complex. Separate areas of included soils are generally less than 1 acre.

Figure 3.—A landscape in an area of Kiti-Rock outcrop complex, 8 to 20 percent slopes. The shallow Kiti soil is between rows of rock outcrops of tilted limestone. This area is in the Edgerock range site and produces native grass.

Most areas of this complex are in native grasses and are used for grazing beef cattle.

This complex has low potential for growing native grasses, but it is best suited to this use. Low to moderate forage yields can be expected with proper management. The quality of native grasses can be improved by controlling brush, proper stocking, controlling grazing, and preventing fires.

The potential for cropland and tame pasture is low. Shallow soil depth, Rock outcrop, and rock on the surface are severe limitations that are difficult and expensive to overcome.

The potential for most urban uses is low. Shallow depth to bedrock and Rock outcrops of hard limestone are severe limitations that are difficult and expensive to overcome.

This map unit is in capability subclass VIIs. The Kiti soil is in the Edgerock range site. Rock outcrop is not assigned to a range site.

38—Kiti-Rock outcrop complex, 8 to 20 percent slopes. This complex consists of very shallow and shallow, well drained, strongly sloping to moderately steep Kiti soil on uplands and Rock outcrops of limestone that are so intermingled that they could not be separated at the scale selected for mapping. This complex is on broad, convex ridgetops and side slopes of the Arbuckle Mountains (fig. 3). The Kiti soil occurs between the rows of limestone Rock outcrop. Slopes are complex. Individual mapped areas range from 100 to 600 acres.

Kiti soil makes up about 55 percent of the complex. Typically, the surface layer is dark grayish brown very flaggy loam about 5 inches thick. The next layer is dark grayish brown very flaggy loam to a depth of about 12 inches. The underlying material is hard, fractured limestone that is tilted 45 degrees from horizontal.

This Kiti soil is high in natural fertility and organic matter content. It is moderately alkaline. The rate of water movement through the soil is moderate, and the available water capacity is very low. The root zone is very shallow and shallow, and root growth is restricted by the limestone bedrock.

Rock outcrop makes up about 35 percent of the complex. Typically, it consists of almost vertical Rock outcrops of limestone that are tilted at about a 45 degree angle. The strata are about 5 to 15 inches thick, are 3 inches to 3 feet high, and appear as long, narrow rows of edgerock.

Included in this complex are small areas of Kingfisher Variant soils. Also included in some mapped areas are small areas of Rayford and Norge Variant soils. These included soils make up about 10 percent of this complex. Separate areas of included soils are generally less than 1 acre.

Most areas of this complex are in native grasses and are used for grazing beef cattle.

This complex has low potential for growing native grasses, but it is best suited to this use. Low to moderate forage yields can be expected with proper management. The quality of native grasses can be improved by controlling brush, proper stocking, controlling grazing, and preventing fires.

The potential for cropland and tame pasture is low. Shallow soil depth, Rock outcrop, and rocks on the surface are severe limitations that are difficult and expensive to overcome.

The potential for most urban uses is low. Shallow depth to bedrock and Rock outcrops of hard limestone are severe limitations that are difficult and expensive to overcome.

The complex is in capability subclass VIIs. The Kiti soil is in the Edgerock range site. Rock outcrop is not assigned to a range site.

39—Kiti-Scullin complex, 2 to 6 percent slopes. This complex consists of small areas of Kiti and Scullin soils that are so intermingled that they could not be separated at the scale selected for mapping. The Kiti and Scullin soils are on convex ridgetops and side slopes of uplands. These soils occur in the southwestern part of the county. Kiti and Scullin soils formed in material weathered from limestone bedrock. Slopes are complex. Individual areas range from 10 to 100 acres.

Kiti soils make up about 45 percent of each mapped area. Typically, the surface layer is dark grayish brown very flaggy silty clay loam that extends to a depth of about 15 inches. The underlying material is hard, fractured limestone that is tilted 50 degrees from horizontal.

The Kiti soils are high in natural fertility and organic matter content. They are moderately alkaline and calcareous. The rate of water movement through the soil is moderate, and the available water capacity is very low. The root zone is shallow to very shallow, and root growth is restricted.

Scullin soils make up about 45 percent of each mapped area. Typically, the surface layer is dark grayish brown clay loam about 7 inches thick. The upper part of the subsoil is dark brown clay loam to a depth of about 12 inches. The middle part is reddish brown clay to a depth of about 26 inches. The lower part of the subsoil is yellowish red flaggy clay to a depth of about 34 inches. The underlying material is hard, fractured limestone that is tilted 50 degrees from horizontal.

The Scullin soils are high in natural fertility and organic matter content. The surface layer is medium acid to slightly acid, and the subsoil is medium acid to moderately alkaline. The rate of water movement through the soil is moderately slow, and the available water capacity is high. The root zone is moderately deep and is favorable for most root growth.

Included in this complex are small, scattered areas of Kingfisher Variant soils and Rock outcrops of limestone. Also included in some mapped areas are small areas of Norge Variant soils. These included soils and Rock outcrop make up about 10 percent of the complex. Separate areas are generally less than 1 acre.

Areas of this complex are mainly in native grasses and are used for grazing beef cattle.

This complex has medium potential for native grasses, and moderate forage yields can be expected with proper management. The quality of native grasses can be improved by controlling brush, proper stocking, controlling grazing, and preventing fires.

The potential for cropland and tame pasture is low. Depth to bedrock and Rock outcrops of hard limestone scattered over the area are severe limitations that are difficult to overcome.

This complex has low potential for most urban uses. Shallow depth to bedrock, Rock outcrops, shrinking and swelling, moderate and moderately slow permeability, and clayey subsoil are limitations that are difficult and expensive to overcome.

This complex is in capability subclass VIIs. The Kiti soils are in the Edgerock range site, and the Scullin soils are in the Loamy Prairie range site.

40—Konawa fine sandy loam, 0 to 2 percent slopes. This deep, well drained, nearly level to very gently sloping soil is on broad, high terraces along the Washita River. Slopes are smooth. Individual areas range from 10 to 60 acres.

Typically, the surface layer is brown fine sandy loam about 8 inches thick. The subsurface layer is light brown fine sandy loam to a depth of about 16 inches. The upper part of the subsoil is yellowish red sandy clay loam to a depth of about 46 inches. The middle part of the subsoil is red sandy clay loam to a depth of about 64 inches. The lower part of the subsoil is red fine sandy loam to a depth of about 78 inches.

This soil is medium in natural fertility and low in organic matter content. It is slightly acid to mildly alkaline throughout. The rate of water movement through the soil is moderate, and the available water capacity is medium. The root zone is deep and is favorable for root growth.

Included with this soil in mapping are small, scattered areas of Bastrop soils. Also included in some mapped areas are small areas of Teller soils. These included soils make up about 15 percent of the mapping unit. Separate areas of included soils are generally less than 3 acres.

Areas of this Konawa soil are used mainly for tame pasture. A minor acreage is cultivated to forage sorghums.

This soil has high potential for cropland. Management concerns for crops are controlling erosion and maintaining soil tilth and fertility. Adding fertilizer helps to increase plant growth, which provides more crop residue to help maintain soil tilth and fertility. Minimum tillage, terraces, farming on the contour, stripcropping, and using crop residue help to control soil erosion. Winter cover crops furnish additional soil protection against wind and water erosion.

The soil has high potential for native grass and tame pasture. Bermudagrass or weeping lovegrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has high potential for most urban uses. There are significant limitations for sanitary landfills and sewage lagoons. Seepage is the main limitation. This limitation can generally be overcome by proper design or by altering the soil.

This Konawa soil is in capability subclass IIe and in the Sandy Savannah range site.

41—Konsil fine sandy loam, 3 to 5 percent slopes. This deep, well drained, gently sloping soil occurs mainly in the southeastern part of the county. Slopes are generally smooth and convex. Individual areas range from 5 to 40 acres.

Typically, the surface layer is brown fine sandy loam about 5 inches thick. The subsurface layer is pink fine sandy loam to a depth of about 10 inches. The upper part of the subsoil is red sandy clay loam to a depth of about 54 inches. The lower part of the subsoil is yellowish red fine sandy loam to a depth of about 72 inches.

This soil is medium in natural fertility and low in organic matter content. The surface layer is medium acid or slightly acid, and the subsoil is strongly acid to slightly acid. The rate of water movement through the soil is moderate, and the available water capacity is medium. The root zone is deep and is favorable for root growth.

Included with this soil in mapping are small areas of Durant soils. Also included in some mapped areas are small areas of sandstone Rock outcrops. These included soils and Rock outcrop make up about 5 percent of the map unit. Separate areas are generally less than 1 acre.

Areas of this soil are used mainly for tame pasture. A minor acreage is used for range.

This soil has high to medium potential for cropland. Management concerns for crops are controlling erosion and maintaining soil tilth and fertility. Adding fertilizer helps to increase plant growth, which provides more crop residue to help maintain soil tilth and fertility. Minimum tillage, terraces, farming on the contour, stripcropping, and using crop residue help to control soil erosion. Winter cover crops furnish additional soil protection against wind and water erosion.

The soil has medium potential for native grass and tame pasture. Bermudagrass or weeping lovegrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has medium to high potential for most urban uses. There are no significant limitations for sanitary landfills, shallow excavations, dwellings, and lawns. Moderate permeability is the main limitation for septic tank absorption fields. Seepage and slope are the main limitations for sewage lagoons. Slope is the main limitation for small commercial buildings. Most of these limitations can be overcome by proper design or by altering the soil.

This Konsil soil is in capability subclass IIIe and in the Sandy Savannah range site.

42—Lula silt loam, 1 to 3 percent slopes. This deep, well drained, very gently sloping soil is in the eastern part of the county. Slopes are smooth and convex. Individual areas range from 3 to 15 acres.

Typically, the surface layer is brown silt loam about 12 inches thick. The upper part of the subsoil is reddish brown silt loam to a depth of about 18 inches. The middle part is reddish brown silty clay loam to a depth of about 32 inches. The lower part of the subsoil is red or reddish brown silty clay loam to a depth of about 58 inches. The underlying material is hard limestone bedrock.

This soil is high in natural fertility and organic matter content. The surface layer and upper part of the subsoil are slightly acid or neutral, and the lower part of the subsoil is neutral. The rate of water movement through the soil is moderate, and the available water capacity is high. The root zone is deep and is favorable for root growth.

Included with this soil in mapping are small areas of Claremore soils. Also included in some mapped areas are small areas of Catoosa soils and a soil that is similar to Lula soil but more than 60 inches thick to limestone bedrock. These included soils make up about 5 percent of this map unit. Separate areas of included soils are generally less than 1 acre.

Areas of this Lula soil are used mainly for tame pasture. Some areas are cultivated to grain sorghum or small grains. A minor acreage is in rangeland and is used for grazing.

This soil has high potential for cropland. Management concerns for crops are controlling erosion and maintaining soil tilth and fertility. Adding fertilizer helps to increase plant growth, which provides more crop residue to help maintain soil tilth and fertility. Minimum tillage, terraces, farming on the contour, stripcropping, and using crop residue help to control soil erosion. Winter cover crops furnish additional soil protection against wind and water erosion.

The soil has high potential for native grass and tame pasture. Bermudagrass or weeping lovegrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has low potential for most urban uses. Depth to rock is the main limitation for septic tank absorption fields, sewage lagoons, sanitary landfills, and shallow excavations. Shrinking and swelling is the main limitation for dwellings, small commercial buildings, and local roads and streets. Most of these limitations can be overcome by proper design or by altering the soil.

This Lula soil is in capability subclass IIe and in the Loamy Prairie range site.

43—McLain silty clay loam, rarely flooded. This deep, moderately well drained, nearly level soil is mainly on slightly concave flood plains of the Washita River and is rarely flooded. Individual areas range from 10 to 80 acres.

Typically, the surface layer is dark reddish brown silty clay loam about 24 inches thick. The upper part of the subsoil is yellowish red silty clay loam to a depth of about 48 inches. The lower part of the subsoil is red silty clay to a depth of about 60 inches. The underlying material is red silt loam to a depth of about 75 inches.

This soil is high in natural fertility and organic matter content. The surface layer and upper part of the subsoil are neutral. Below this the soil is moderately alkaline. The rate of water movement through the soil is slow, and the available water capacity is high. The root zone is deep and is favorable for root growth. This soil has fair tilth and can be worked only in a narrow moisture range.

Included with this soil in mapping are small areas of Dale soils. Also included in some mapped areas are Watonga soils. These included soils make up about 5 percent of this map unit. Separate areas of included soils are generally less than 1 acre.

Areas of this McLain soil are mainly cultivated to small grains. A minor acreage is used for tame pasture.

This soil has high potential for cropland. Management concerns for crops are maintaining soil tilth and fertility. Adding fertilizer helps to increase plant growth, which provides more crop residue to help maintain soil tilth and fertility.

This soil has high potential for native grass and tame pasture. Bermudagrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has low potential for most urban uses. Flooding, slow permeability, and shrinking and swelling are the main limitations for sanitary landfills, dwellings, small commercial buildings, septic tank absorption fields, and local roads and streets. Most of these limitations are difficult and expensive to overcome.

This McLain soil is in capability class I and in the Heavy Bottomland range site.

44—Norge Variant silt loam, 1 to 3 percent slopes. This deep, well drained, very gently sloping soil is on uplands mainly in the southern half of the county. Slopes are generally smooth and convex. Individual areas range from 5 to 40 acres.

Typically, the surface layer is grayish brown silt loam about 12 inches thick. The upper part of the subsoil is reddish brown and light reddish brown clay loam to a depth of about 55 inches. The lower part of the subsoil is red clay to a depth of about 75 inches. The underlying material is hard, tilted limestone.

This soil is high in natural fertility and organic matter content. It is medium acid to neutral throughout. The rate of water movement through the soil is slow, and the available water capacity is high. The root zone is deep and is favorable for root growth.

Included with this soil in mapping are small areas of Kingfisher Variant soils. Also included in some mapped areas are small areas of Kiti soils. These included soils make up about 5 percent of the map unit. Separate areas of included soils are generally less than 1 acre.

Areas of this Norge Variant soil are used mainly for native range. Some minor areas are cultivated to forage sorghum or tame pasture.

This soil has high potential for cropland. Management concerns for crops are controlling erosion and maintaining soil tilth and fertility. Adding fertilizer helps to increase plant growth, which provides more crop residue to help maintain soil tilth and fertility. Minimum tillage, terraces, farming on the contour, stripcropping, and using crop residue help to control soil erosion. Winter cover crops furnish additional soil protection against wind and water erosion.

The soil has high potential for native grass and tame pasture. Bermudagrass or weeping lovegrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has medium potential for most urban uses. Shrinking and swelling is a limitation for dwellings, small commercial buildings, and roads and streets. Slow permeability is a limitation for septic tank absorption fields. The subsoil is too clayey for trench type sanitary landfills. Slope is a limitation for sewage lagoons. Most of these limitations can be overcome by proper design or by altering the soil.

This Norge Variant soil is in capability subclass IIe and in the Loamy Prairie range site.

45—Pits, quarries. This miscellaneous area consists of areas where soils and limestone have been excavated, leaving pits. Individual areas are 3 to 40 acres. These areas are 5 to 100 feet deep, 300 to 1,320 feet long, and 150 to 600 feet wide. Most of the pits hold water for long to short periods. These areas have nearly vertical sides and very gently sloping to sloping bottoms. Most of the material from these areas is used for building roads, dams, foundations, and other similar structures.

Included in this map unit are small areas where soils and shale have been excavated. The side slopes support a sparse stand of grasses in some areas. These included areas make up about 25 percent of this map unit.

Most areas of this map unit are not suited to revegetation, but small areas filled with water provide some habitat for wildlife. Minor areas, where the pits were dug in shale, are suited to native grass and improved bermudagrass and are best used as wildlife habitat.

In these minor areas, the main concerns in management are leveling the steep slopes, controlling erosion, and maintaining tilth and fertility. Management is needed to establish or to improve and maintain plant cover. Land leveling, establishing a desirable plant cover, controlling grazing, and adding fertilizer are needed in most places.

This map unit is not assigned to a capability subclass or range site.

46—Rayford cobbly loam, 5 to 20 percent slopes. This shallow, well drained, sloping to moderately steep soil is on uplands. It is mainly in the northern and western parts of the Arbuckle Mountains. About 25 percent of the surface is covered with limestone cobbles. Slopes are complex. Individual areas range from 50 to 400 acres.

Typically, the surface layer is dark grayish brown cobbly loam about 11 inches thick. The next layer is brown very cobbly clay loam to a depth of about 16 inches. The underlying material is indurated limestone conglomerate.

This soil is high in natural fertility and organic matter content. It is moderately alkaline throughout. The rate of water movement through the soil is moderate, and the available water capacity is low. The root zone is shallow, and root growth is restricted by the limestone conglomerate bedrock.

Included with this soil in mapping are small areas of Kiti and Shidler soils. Also included in some mapped areas are small areas of Grainola and Kingfisher Variant soils and Rock outcrop. These included soils and Rock outcrop make up about 15 percent of this map unit. Separate areas are generally less than 3 acres.

Areas of the Rayford soil are mainly in rangeland and are used for grazing.

This soil has low potential for growing native grasses, but it is best suited to this use (fig. 4). Low to moderate forage yields can be expected with proper management. The quality of native grasses can be improved by controlling brush, proper stocking, controlling grazing, and preventing fires.

The potential for cropland and tame pasture is low. Shallow soil depth, steepness, and coarse fragments of limestone are severe limitations that are difficult to overcome.

The potential for most urban uses is low. Shallow depth to bedrock and slope are the main limitations for septic tank absorption fields, sewage lagoons, area type sanitary landfills, shallow excavations, dwellings, small commercial buildings, and local roads and streets. Shallow depth to bedrock, slope, and large stones are the main limitations for trench type sanitary landfills, lawns, landscaping, and golf fairways. These limitations are difficult and expensive to overcome.

This Rayford soil is in capability subclass VIIs and in the Shallow Prairie range site.

47—Rayford-Urban land complex, 5 to 20 percent slopes. This complex is on sloping to moderately steep side slopes. The areas are long, broad, and irregular in shape. The Rayford soils and Urban land in this complex are so intermingled that they could not be separated at the scale selected for mapping. This complex is 45 percent Rayford soils, 30 percent Urban land, and 25 percent Rock outcrop and other soils.

Typically, the surface layer of the Rayford soils is dark grayish brown cobbly loam about 8 inches thick. The next layer is brown very cobbly clay loam to a depth of 14 inches. The underlying material is indurated limestone conglomerate.

The Rayford soils are high in natural fertility and organic matter content. They are moderately alkaline throughout. The rate of water movement through the soil is moderate, and the available water capacity is low. The root zone is shallow, and root growth is restricted by the limestone conglomerate bedrock.

Figure 4.—Buffalograss, pricklypear cactus, and juniper are dominant in an overgrazed area of Rayford cobbly loam, 5 to 20 percent slopes. This soil is in the Shallow Prairie range site.

Urban land consists of areas that are covered by single unit dwellings, streets, driveways, sidewalks, commercial buildings, and patios.

The more sloping soils of this complex have been modified by excavating, filling, and grading for building sites and dwellings. This alteration ranges in depth from 4 to 8 feet, depending on the slope. In places, split-level construction has been used to offset the effect of steep slopes on foundations. Larger stones are commonly removed, and most yards are topdressed with 2 to 4 or more inches of loamy or sandy fill materials. About a fourth of the area of this complex that is not covered with streets, driveways, sidewalks, or structures is modified in this way. The majority of roads and streets are constructed on the contour.

Areas of this complex are used for urban development, mainly picnic areas, playground areas, dwellings, buildings, and roads and streets.

The main concerns in using these soils in urban areas are shallow depth to bedrock, slope, and large stones. There are severe limitations for septic tank absorption fields, sewage lagoons, sanitary landfills, shallow excavations, dwellings, small commercial building, roads, streets, lawns, landscaping, and golf fairways. The soils in this complex are poorly suited to trees, garden plants, shrubs, and flowers.

This complex is not placed in a capability subclass or range site.

48—Renfrow silt loam, 1 to 3 percent slopes. This deep, well drained, very gently sloping soil is in the western part of the county. It formed in material weathered from clayey shales of red beds. Slopes are convex. Individual areas range from 5 to 30 acres.

Typically, the surface layer is reddish brown silt loam about 10 inches thick. The upper part of the subsoil is reddish brown silty clay loam to a depth of about 16 inches. The middle part is yellowish red silty clay to a depth of about 38 inches. The lower part of the subsoil is red silty clay to a depth of about 62 inches. The underlying material is red clayey shale.

This soil is high in natural fertility and organic matter content. It is neutral to moderately alkaline. The rate of water movement through the soil is very slow, and the available water capacity is high. The root zone is deep and is favorable for most root growth.

Included with this soil in mapping are small areas of Grainola soils. These included soils make up about 10 percent of the map unit. Separate areas of included soils are generally less than 2 acres.

Areas of this Renfrow soil are used mainly for tame pasture. Some areas are cultivated to forage sorghum. A minor acreage is used for range.

This soil has high potential for cropland. Management concerns for crops are controlling erosion and maintaining soil tilth and fertility. Adding fertilizer helps to increase plant growth, which provides more crop residue to help soil tilth and fertility. Minimum tillage, terraces, farming on the contour, stripcropping, and using crop residue help to control soil erosion. Winter cover crops furnish additional soil protection against wind and water erosion.

The soil has high potential for native grass and tame pasture. Bermudagrass or weeping lovegrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has low potential for most urban uses. Shrinking and swelling is the main limitation for dwellings, small commercial buildings, and roads and streets. Very slow permeability is the main limitation for septic tank absorption fields. The subsoil is too clayey for trench type sanitary landfills, and slope is the main limitation for sewage lagoons. Most of the limitations can be overcome by proper design or by altering the soil.

This Renfrow soil is in capability subclass IIIe and in the Claypan Prairie range site.

49—Renfrow silt loam, 3 to 5 percent slopes. This deep, well drained, gently sloping soil is in the western part of the county. It formed in material weathered from clayey shales of red beds. Slopes are convex. Individual areas range from 5 to 30 acres.

Typically, the surface layer is dark reddish gray silt loam about 9 inches thick. The upper part of the subsoil is reddish brown silty clay loam to a depth of about 15 inches. The middle part is yellowish red silty clay to a depth of about 36 inches. The lower part of the subsoil is red silty clay to a depth of about 58 inches. The underlying material is red clayey shale.

This soil is high in natural fertility and organic matter content. It is neutral to moderately alkaline. The rate of water movement through the soil is very slow, and the available water capacity is high. The root zone is deep and is favorable for most root growth.

Included with this soil in mapping are small areas of Grainola soils. These included soils make up about 12 percent of this map unit. Separate areas of included soils are generally less than 3 acres.

Areas of this Renfrow soil are used mainly for tame pasture. Some areas are cultivated to forage sorghum. A minor acreage is used for range.

This soil has medium to high potential for cropland. Management concerns for crops are controlling erosion and maintaining soil tilth and fertility. Adding fertilizer helps to increase plant growth, which provides more crop residue to help maintain soil tilth and fertility. Minimum tillage, terraces, farming on the contour, stripcropping, and using crop residue help to control soil erosion. Winter cover crops furnish additional soil protection against wind and water erosion.

The soil has medium to high potential for native grass and tame pasture. Bermudagrass or weeping lovegrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has low potential for most urban uses. Shrinking and swelling is the main limitation for dwellings, small commercial buildings, and roads and streets. Very slow permeability is the main limitation for septic tank absorption fields. The subsoil is too clayey for trench type sanitary landfills, and slope is the main limitation for sewage lagoons. Most of these limitations can be overcome by proper design or by altering the soil.

This Renfrow soil is in capability subclass IVe and in the Claypan Prairie range site.

50—Rock outcrop-Kiti complex, 20 to 45 percent slopes. This map unit consists of shallow and very shallow, well drained, steep Kiti soils and Rock outcrops of limestone that are so intermingled that they could not be separated at the scale selected for mapping. This complex is on convex ridgetops and side slopes of the Arbuckle Mountains (fig. 5). The Kiti soils are between the rows of Rock outcrop. Slopes are complex. Individual areas range from 200 to 1,000 acres.

Rock outcrop makes up about 75 percent of the complex. Typically, it consists of almost vertical, massive

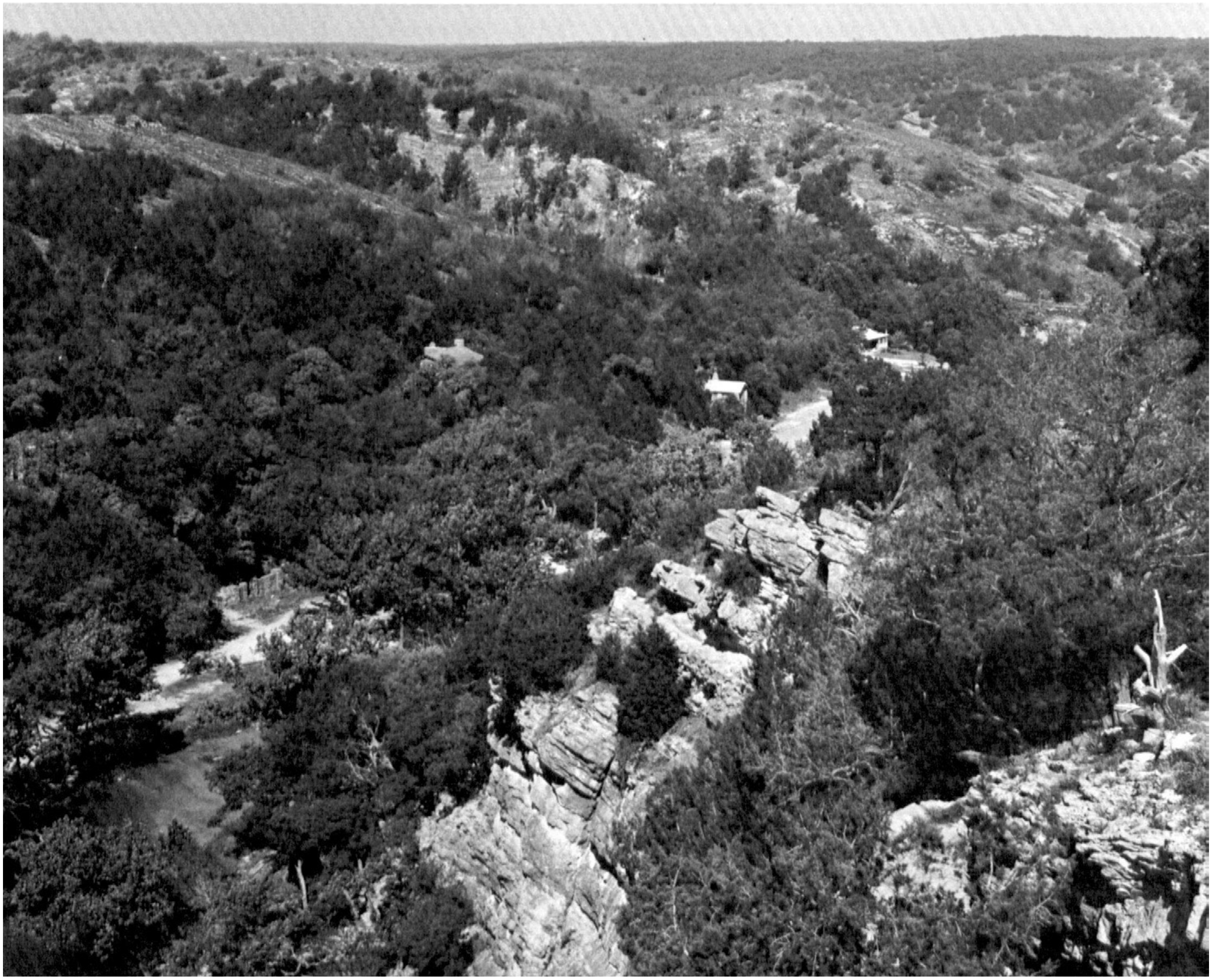


Figure 5.—A landscape in an area of Rock outcrop-Kiti complex, 20 to 45 percent slopes, showing juniper along breaks of the rock outcrops. The soils of this complex are used mostly for rangeland, recreation, and retreats.

limestone strata that are tilted at about a 90 degree angle. The strata are about 15 inches to 5 feet thick and appear as long, narrow rows of edgerock and massive boulders.

Kiti soils make up about 15 percent of the complex. Typically, the surface layer is dark grayish brown very flaggy loam about 5 inches thick. The next layer to a depth of 12 inches is dark grayish brown very flaggy loam. The underlying material is hard fractured limestone that is tilted 90 degrees from horizontal.

The Kiti soils are high in natural fertility and organic matter content. They are mildly alkaline or moderately alkaline. The rate of water movement through the soil is moderate, and the available water capacity is very low. The root zone is shallow, and root growth is restricted by the limestone bedrock.

Included in this complex are small areas of Kingfisher Variant soils. Also included in some mapped areas are small areas of Rayford soils. These included soils make up about 10 percent of this complex. Separate areas of included soils are generally less than 1 acre.

Most areas of this complex are in native grasses and are used for grazing beef cattle.

This complex has low potential for growing native grasses, but it is best suited to this use. Low forage yields can be expected with proper management. The quality of native grasses can be improved by controlling brush, proper stocking, controlling grazing, and preventing fires.

The potential for cropland and tame pasture is low. Shallow soil depth, Rock outcrop, steep slopes, and rocks on the surface are severe limitations that are difficult and expensive to overcome.

The potential for most urban uses is low. Shallow depth to bedrock, steep slopes, and Rock outcrops of hard limestone are limitations that are difficult and expensive to overcome.

This map unit is in capability subclass VIIs. The Kiti soils are in the Breaks range site. Rock outcrop is not assigned to a range site.

51—Shidler-Clarita complex, 2 to 8 percent slopes. This complex consists of very shallow or shallow, well drained Shidler soils and deep, moderately well drained Clarita soils on uplands. These very gently sloping to sloping soils occur mainly in the north-central part of the county. Areas of these soils are so intermingled that they could not be shown separately at the scale selected for mapping. Shidler soils are on ridgetops, and Clarita soils are on side slopes. Slopes are complex. Individual areas range from 15 to 200 acres.

Shidler soils make up about 45 percent of the complex. Typically, the surface layer is dark grayish brown silty clay loam about 10 inches thick. The underlying material is hard fractured limestone.

Shidler soils are high in natural fertility and organic matter content. They are neutral to moderately alkaline throughout. The rate of water movement through the soil is moderate, and the available water capacity is low. The root zone is very shallow or shallow and root growth is restricted by the limestone bedrock.

Clarita soils make up about 45 percent of the complex. Typically, the surface layer is dark gray silty clay about 8 inches thick. The next layer is dark grayish brown silty clay to a depth of about 14 inches. The subsoil is reddish brown silty clay to a depth of about 60 inches.

Clarita soils are high in natural fertility and organic matter content. They are neutral to moderately alkaline throughout. The rate of water movement through the soil is very slow, and the available water capacity is high. The root zone is deep, and root growth is somewhat restricted by the clayey subsoil.

Included in this complex are small areas of Chigley and Durant soils and Rock outcrop. These included soils and Rock outcrop make up about 10 percent of this complex. Separate areas are generally less than 2 acres.

Most areas of this complex are in native grasses and are used for grazing beef cattle.

This complex has medium potential for growing native grasses, and it is best suited to this use. Moderate forage yields can be expected with proper management. The quality of native grasses can be improved by controlling brush, proper stocking, controlling grazing, and preventing fires.

The potential for cropland and tame pasture is low. Large stones on the surface, slope, and depth to rock are severe limitations that are difficult to overcome.

The potential for most urban uses is low. Depth to rock, shrinking and swelling, and very slow permeability are limitations that are difficult and expensive to overcome.

This complex is in capability subclass VIIs. The Shidler soils are in the Very Shallow range site, and the Clarita soils are in the Blackclay Prairie range site.

52—Shidler-Rock outcrop complex, 2 to 8 percent slopes. This complex consists of very shallow or shallow, well drained Shidler soils and Rock outcrop on very gently sloping to sloping uplands. This complex occurs mainly in the northeastern part of the county. The Shidler soils and Rock outcrop are so intermingled that they could not be shown separately at the scale selected for mapping. Slopes are complex. Individual areas range from 40 to 300 acres.

Shidler soils make up about 60 percent of the complex. Typically, the surface layer is reddish brown silty clay loam about 8 inches thick. The underlying material is hard, fractured limestone.

Shidler soils are high in natural fertility and organic matter content. They are slightly acid to moderately alkaline throughout. The rate of water movement through the soil is moderate, and the available water capacity is low. The root zone is very shallow or shallow, and root growth is restricted by the limestone bedrock.

Rock outcrop makes up about 30 percent of the complex. It consists of exposure of bare, hard, grayish limestone bedrock. Rock outcrop supports very few plants, and it has very rapid surface runoff.

Included in this complex are small areas of Kiti and Rayford soils. Also included in some mapped areas are small areas of Claremore, Clarita, and Catoosa soils. These included soils make up about 10 percent of this complex. Separate areas are generally less than 2 acres.

Most areas of this complex are in native grasses and are used for grazing beef cattle.

This complex has low potential for growing native grasses, but it is best suited to this use. Low to moderate forage yields can be expected with proper management. The quality of native grasses can be improved by controlling brush, proper stocking, controlling grazing, and preventing fires.

The potential for cropland and tame pasture is low. Depth to rock and Rock outcrops of limestone are severe limitations that are difficult and expensive to overcome.

The potential for most urban uses is low. Depth to bedrock and Rock outcrop are severe limitations that are difficult and expensive to overcome.

This complex is in capability subclass VIIs. Shidler soils are in the Very Shallow range site. Rock outcrop is not assigned to a range site.

53—Stephenville Variant fine sandy loam, 3 to 5 percent slopes. This moderately deep, well drained, gently sloping soil is on uplands mainly in the extreme eastern part of the county. Occasional areas occur in the western part of the county. Slopes are mainly complex. Individual areas range from 5 to 50 acres.

Typically, the surface layer is brown fine sandy loam about 6 inches thick. The subsurface layer is light yellowish brown fine sandy loam to a depth of about 14 inches. The subsoil is yellowish red sandy clay loam to a depth of about 36 inches. The underlying material is reddish brown, indurated sandstone tilted 30 degrees from horizontal.

This soil is low in natural fertility and organic matter content. It is medium acid or slightly acid. The rate of water movement through the soil is moderate, and the available water capacity is medium. The root zone is moderately deep and is favorable for root growth.

Included with this soil in mapping are small areas of Gasil soils. Also included in some mapped areas are areas of Darnell Variant soils. These included soils make up about 5 percent of this map unit. Separate areas of included soils are generally less than 1 acre.

Areas of this Stephenville Variant soil are used mainly for tame pasture. Some areas are cultivated to forage sorghum. A minor acreage is used for range.

This soil has medium potential for cropland. Management concerns for crops are controlling erosion and maintaining soil tilth and fertility. Adding fertilizer helps to increase plant growth, which provides more crop residue to help maintain soil tilth and fertility. Minimum tillage, terraces, farming on the contour, stripcropping, and using crop residue help to control soil erosion. Winter cover crops furnish additional soil protection against wind and water erosion.

The soil has medium potential for native grass and tame pasture. Bermudagrass or weeping lovegrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has low to medium potential for most urban uses. Depth to rock is the main limitation for septic tank absorption fields, sanitary landfills, sewage lagoons, shallow excavations, dwellings, small commercial buildings, roads, streets, lawns, landscaping, and golf fairways. This limitation is expensive and difficult to overcome.

This Stephenville Variant soil is in capability subclass IIIe and in the Sandy Savannah range site.

54—Stephenville Variant-Darnell Variant complex, 5 to 20 percent slopes. This complex consists of moderately deep, well drained Stephenville Variant soils and shallow, well drained Darnell Variant soils on uplands. Areas of these soils are so intermingled that they could not be separated at the scale selected for mapping. Stephenville Variant soils are on side slopes and upper foot slopes. Darnell Variant soils are on ridgetops. This complex is mainly in the extreme eastern part of the county; some areas are in the western part. Slopes are complex. Individual areas range from 5 to 40 acres.

Stephenville Variant soils make up about 60 percent of the complex. Typically, the surface layer is pale brown fine sandy loam about 6 inches thick. The subsurface layer is light yellowish brown fine sandy loam to a depth of about 14 inches. The subsoil is reddish yellow sandy clay loam to a depth of about 32 inches. The underlying material is brown, indurated sandstone that is tilted 30 degrees from horizontal.

Stephenville Variant soils are low in natural fertility and organic matter content. The surface and subsurface layers are medium acid to slightly acid, and the subsoil is strongly acid to slightly acid. The rate of water movement through the soil is moderate, and the available water capacity is medium. The root zone is moderately deep and is favorable for most root growth.

Darnell Variant soils make up about 30 percent of the complex. Typically, the surface layer is light brownish gray fine sandy loam about 6 inches thick. The subsoil is pale brown fine sandy loam to a depth of about 14 inches. The underlying material is brown, indurated sandstone that is tilted 30 degrees from horizontal.

Darnell Variant soils are low in natural fertility and organic matter content. They are strongly acid to slightly acid. The rate of water movement through the soil is moderately rapid, and the available water capacity is low. The root zone is shallow, and root growth is restricted by hard sandstone bedrock.

Included in this complex are small areas of Gasil soils and Rock outcrop. Also included in some mapped areas are small areas of Fitzhugh soils. These included soils and Rock outcrop make up about 10 percent of the complex. Separate areas are generally less than 1 acre.

Areas of this complex are used mainly for range. A minor acreage is used for tame pasture.

This complex has medium potential for native grass and tame pasture. Bermudagrass or weeping lovegrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This complex has low potential for cropland. Depth to rock and slope are severe limitations that are difficult to overcome.

The potential for most urban uses is low. Depth to rock and slope are the main limitations for septic tank absorption fields, sewage lagoons, sanitary landfills, dwellings, small commercial buildings, and roads and streets. Most of these limitations can be overcome by proper design or by altering the soil.

This complex is in capability subclass VIe. The Stephenville Variant soils are in the Sandy Savannah range site, and the Darnell Variant soils are in the Shallow Savannah range site.

55—Teller loam, 0 to 1 percent slopes. This deep, well drained, nearly level soil is on high stream terraces near the Washita River. Slopes are smooth. Individual areas range from 5 to 40 acres.

Typically, the surface layer is brown loam about 11 inches thick. The upper part of the subsoil is reddish brown loam to a depth of about 22 inches. The middle part of the subsoil is yellowish red sandy clay loam to a depth of about 56 inches. The lower part of the subsoil is yellowish red fine sandy loam to a depth of about 72 inches.

This soil is high in natural fertility and organic matter content. The surface layer is medium acid or slightly acid, and the subsoil is medium acid to neutral. The rate of water movement through the soil is moderate, and the available water capacity is high. The root zone is deep and is favorable for root growth. This soil has good tilth and can be worked throughout a wide range in moisture content.

Included with this soil in mapping are small areas of Bastrop soils. Also included in some mapped areas are areas of Konawa soils. These included soils make up about 10 percent of the map unit. Separate areas of included soils are generally less than 1 acre.

Areas of this Teller soil are used mainly for cultivated crops. Some areas are used for tame pasture. A very minor acreage is used for range.

This soil has high potential for cropland. Management concerns for crops are controlling erosion and maintaining soil tilth and fertility. Adding fertilizer helps to increase plant growth, which provides more crop residue to help maintain soil tilth and fertility. Minimum tillage, terraces, farming on the contour, stripcropping, and using crop residue help to control soil erosion. Winter cover crops furnish additional soil protection against wind and water erosion.

This soil has high potential for native grass and tame pasture. Bermudagrass or weeping lovegrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has medium potential for urban uses. There are no significant limitations for area type sanitary landfills, shallow excavations, dwellings, small commercial buildings, roads, streets, lawns, landscaping, and golf fairways. Seepage and moderate permeability are the main limitations for sewage lagoons, trench type sanitary landfills, and septic tank absorption fields. Most of these limitations can be overcome by proper design or by altering the soil.

This Teller soil is in capability class I and the Loamy Prairie range site.

56—Teller loam, 1 to 3 percent slopes. This deep, well drained, very gently sloping soil is on high stream terraces near the Washita River. Slopes are smooth. Individual areas range from 5 to 40 acres.

Typically, the surface layer is brown loam about 10 inches thick. The upper part of the subsoil is reddish brown loam to a depth of about 22 inches. The middle part of the subsoil is yellowish red sandy clay loam to a depth of about 55 inches. The lower part of the subsoil is yellowish red fine sandy loam to a depth of about 75 inches.

This soil is high in natural fertility and organic matter content. The surface layer is medium acid or slightly acid. The rate of water movement through the soil is moderate, and the available water capacity is high. The root zone is deep and is favorable for root growth. This soil has good tilth and can be worked throughout a wide range in moisture content.

Included with this soil in mapping are small areas of Bastrop soils. Also included in some mapped areas are areas of Konawa soils. These included soils make up about 10 percent of the map unit. Separate areas of included soils are generally less than 1 acre.

Areas of this Teller soil are used mainly for cultivated crops. Some areas are used for tame pasture. A very minor acreage is used for range.

This soil has high potential for cropland. Management concerns for crops are controlling erosion and maintaining soil tilth and fertility. Adding fertilizer helps to increase plant growth, which provides more crop residue to help maintain soil tilth and fertility. Minimum tillage, terraces, farming on the contour, stripcropping, and using crop residue help to control soil erosion. Winter cover crops furnish additional soil protection against wind and water erosion.

The soil has high potential for native grass and tame pasture. Bermudagrass or weeping lovegrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has medium potential for urban uses. There are no significant limitations for area type sanitary landfills, shallow excavations, dwellings, small commercial buildings, roads, streets, lawns, landscaping, and golf fairways. Seepage and moderate permeability are the main limitations for sewage lagoons, trench type sanitary landfills, and septic tank absorption fields. Most of these limitations can be overcome by proper design or by altering the soil.

This Teller soil is in capability subclass IIe and in the Loamy Prairie range site.

57—Timhill stony silt loam, 5 to 30 percent slopes. This shallow, well drained, sloping to steep soil is in the southwestern part of the county. This soil is on ridgetops and upper side slopes of the Arbuckle Mountains. Slopes are complex. Individual areas range from 100 to 400 acres.

Typically, the surface layer is dark brown stony silt loam about 7 inches thick. The subsoil is brown very gravelly silt loam to a depth of about 15 inches. The upper part of the underlying material is yellowish red very gravelly loam to a depth of about 18 inches, and the lower part is indurated rhyolite tilted 40 degrees from horizontal.

This soil has medium fertility and organic matter content. It is medium acid to neutral. The rate of water movement through the soil is moderate, and the available water capacity is low. The root zone is shallow, and root penetration is restricted by indurated rhyolite bedrock.

Included with this soil in mapping are a few areas of rock outcrop and areas of soils that are similar except they are less than 10 inches deep to bedrock and the dominant vegetation is native grasses. These areas are on ridgetops and extreme upper side slopes. Also included are small areas of soils that are similar except they are more than 20 inches deep to bedrock and they have a thicker and more clayey subsoil. These included soils make up about 15 percent of this map unit. Separate areas generally range from 5 to 15 acres in narrow bands less than 100 feet wide.

Most areas of this soil are in native grasses and are used for grazing beef cattle (fig. 6).

The potential for cropland and tame pasture is low. Shallow soil depth, Rock outcrop, steep slopes, and rocks on the surface are severe limitations that are difficult to overcome.

This soil has low potential for growing native grasses, but it is best suited to this use. Low forage yields can be expected with proper management. The quality of native grasses can be improved by controlling brush, proper stocking, controlling grazing, and preventing fires.

The potential for most urban uses is low. Shallow depth to bedrock, steep slopes, and Rock outcrop of hard rhyolite are severe limitations that are difficult and expensive to overcome.

This Timhill soil is in capability subclass VIIs and in the Granite Hills range site.

58—Travertine-Bromide complex, 5 to 25 percent slopes. This complex consists of small areas of the Bromide and Travertine soils that are so intermingled that they could not be separated at the scale selected for mapping. The complex occurs as large areas that range from 100 to 300 acres. Areas are about 1/4 to 1/2 mile wide on narrow, winding ridgetops and steep side slopes. Individual areas of each soil are 1/4 to 1 acre.

Travertine soil makes up about 45 percent of the complex. Typically, the surface layer is pale brown channery silt loam about 13 inches thick. The subsoil is pink extremely channery loam to a depth of about 18 inches. The underlying material is platy, siliceous shale and siltstone that is tilted 60 degrees from horizontal.

This Travertine soil is low in natural fertility and organic matter content. The surface layer is medium acid or slightly acid, and the subsoil is medium acid to neutral. The rate of water movement through the soil is moderate, and the available water capacity is low. The root zone is shallow, and root penetration is restricted by shale and siltstone bedrock.

Bromide soil makes up about 40 percent of the complex. Typically, the surface layer is brown channery silt loam about 4 inches thick. The subsurface layer is light brown channery silt loam to a depth of about 18 inches. The upper part of the subsoil, to a depth of about 32 inches, is light brown extremely channery silty clay that has yellowish red and pale brown mottles. The lower part of the subsoil is pink extremely channery silt loam to a depth of about 36 inches. The underlying material is platy, siliceous shale and siltstone tilted 60 degrees from horizontal.

This Bromide soil is low in natural fertility and organic matter content. The rate of water movement through the soil is moderate and the available water capacity is medium. The soil is strongly acid to slightly acid throughout. The root zone is moderately deep and is favorable for most root growth.

Included in this complex are small areas of soils that are similar to the Travertine soil but are less than 10 inches deep to shale and siltstone bedrock. These included soils make up about 15 percent of this complex. Separate areas of included soils are generally less than 1 acre.

Most areas of this complex are in native grasses and are used for grazing beef cattle.

This complex has low potential for growing native grasses, but it is best suited to this use. Low forage yields can be expected with proper management. The quality of native grasses can be improved by controlling

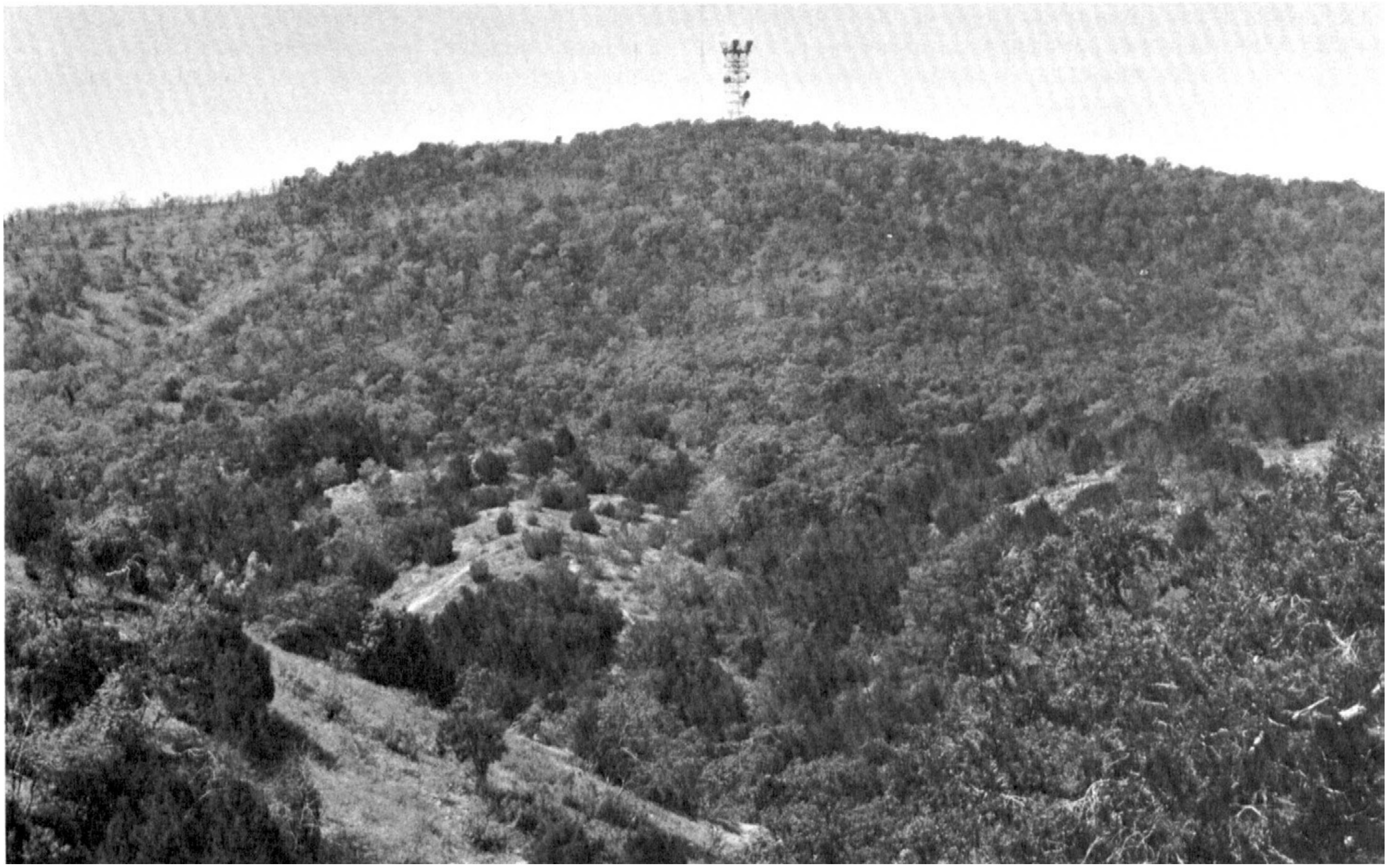


Figure 6.—An area of Timhill stony silt loam, 5 to 30 percent slopes. This soil has low potential for producing mid grasses because of the shallow soil depth and the invasion of juniper.

brush, proper stocking, controlling grazing, and preventing fires.

The potential for cropland and tame pasture is low. Shallow soil depth, Rock outcrop, steep slopes, and rocks on the surface are severe limitations that are difficult to overcome.

The potential for most urban uses is low. Shallow depth to bedrock, steep slopes, and large stones are limitations for septic tank absorption fields, sewage lagoons, sanitary landfills, shallow excavations, dwellings, and small commercial buildings. These limitations are difficult and expensive to overcome.

This complex is in capability subclass VIIe. The Travertine soil is in the Shallow Savannah range site and the Bromide soil is in the Sandy Savannah range site.

59—Tussy clay, 2 to 5 percent slopes. This moderately deep, well drained, very gently sloping to gently sloping soil is on side slopes of uplands. It formed in material weathered from calcareous clay and shaly clay. Slopes are smooth to irregular and convex. Individual areas range from 10 to 50 acres.

Typically, the surface layer is reddish brown clay about 6 inches thick. The subsoil is reddish brown clay that extends to a depth of 28 inches. The underlying material is red and pale olive shaly clay.

This soil is medium in natural fertility and low in organic matter content. It is moderately alkaline and calcareous throughout. The rate of water movement through the soil is very slow, and the available water capacity is medium. The root zone is moderately deep and is somewhat restricted by the clayey subsoil.

Included with this soil in mapping are small areas of Clarita soils. Also included in some mapped areas are small areas of Chigley soils. These included soils make up about 15 percent of the map unit. Separate areas of included soils are generally less than 2 acres.

Areas of this Tussy soil are used mainly for tame pasture. A minor acreage is in native range.

This soil has low potential for cropland. Management concerns for crops are controlling erosion and maintaining soil tilth and fertility. Adding fertilizer helps to increase plant growth, which provides more crop residue to help maintain soil tilth and fertility. Minimum tillage, terraces, farming on the contour, stripcropping, and using crop residue help to control soil erosion. Winter cover crops furnish additional soil protection against wind and water erosion.

The soil has low potential for native grass and tame pasture. Bermudagrass, plains bluestem, or weeping lovegrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has low potential for most urban uses. Shrinking and swelling is the main limitation for dwellings, small commercial buildings, and roads and streets. Very slow permeability is the main limitation for septic tank absorption fields. Slope is the main limitation for sewage lagoons. The soil is too clayey for trench type sanitary landfills. Most of these limitations are difficult and expensive to overcome, but with proper design or by altering the soil, some of these limitations can be overcome.

This Tussy soil is in capability subclass IVe and in the Red Clay Prairie range site.

60—Tussy clay, 5 to 30 percent slopes, eroded. This moderately deep, well drained, sloping to steep soil is on side slopes of uplands. It formed in material weathered from reddish, calcareous clay and shaly clay. Slopes are smooth to irregular and convex. Individual areas range from 10 to 80 acres.

Typically, the surface layer is reddish brown clay about 8 inches thick. The subsoil is reddish brown clay that extends to a depth of 26 inches. The underlying material is yellowish red clay.

This soil is medium in natural fertility and low in organic matter content. It is moderately alkaline and calcareous throughout. The rate of water movement through the soil is very slow, and the available water capacity is medium. The root zone is moderately deep and is somewhat restricted by the clayey subsoil.

Included with this soil in mapping are small areas of Clarita soils. Also included in some mapped areas are areas of Chigley soils. These included soils make up about 10 percent of the map unit. Separate areas of included soils are generally less than 2 acres.

Areas of this Tussy soil are used mainly for tame pasture. A minor acreage is in native range.

This soil has low potential for native grass and tame pasture. Bermudagrass, plains bluestem, or weeping lovegrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has low potential for cropland. Slope is the main limitation and is difficult and expensive to overcome.

This soil has low potential for most urban uses. Shrinking and swelling and slope are the main limitations for dwellings, small commercial buildings, and roads and streets. Very slow permeability and slope are limitations for septic tank absorption fields. Slope is a limiting factor for sewage lagoons and trench type sanitary landfills. The soil is also too clayey for trench type sanitary landfills. Most of these limitations are difficult and expensive to overcome, but with proper design or by altering the soil, some of these limitations can be overcome.

This Tussy soil is in capability subclass VIIe and in the Red Clay Prairie range site.

61—Watonga clay, rarely flooded. This deep, moderately well drained soil is on the flood plain of the Washita River. Areas of this soil are rarely flooded. The soil is nearly level with some concave areas. Individual areas range from 5 to 200 acres.

Typically, the surface layer is very dark gray clay about 20 inches thick. The next layer is dark grayish brown clay to a depth of about 50 inches. The underlying material is reddish brown clay.

This soil is high in natural fertility and organic matter content. The surface layer is neutral to moderately alkaline and the subsoil is moderately alkaline. The rate of water movement through the soil is very slow, and the available water capacity is high. The root zone is deep and is somewhat restricted by the subsoil.

Included with this soil in mapping are similar soils that have a high sodium content and poor surface drainage. Also included in some mapped areas are areas of McLain soils and soils that are similar to the Watonga soil except that the lower part of the soil is reddish. These included soils make up about 30 percent of this map unit. Separate areas of included soils are generally less than 3 acres.

Areas of this Watonga soil are mainly used for cropland. A very minor acreage is in tame pasture.

This soil has high potential for growing most locally adapted crops, but the soil texture and permeability are limiting factors for crop yields. Management concerns for crops are maintaining soil tilth and fertility. Adding fertilizer helps to increase plant growth, which provides more crop residue to help maintain soil tilth and fertility.

The soil has high potential for native grass and tame pasture. Bermudagrass or weeping lovegrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of the grass. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has low potential for most urban uses. Flooding and shrinking and swelling are limitations for dwellings, small commercial buildings, and roads and streets. Very slow permeability is the limitation on septic tank absorption fields. The soil is clayey, which is a limitation for trench type sanitary landfills. Most of these limitations are difficult and expensive to overcome, but they can be overcome by proper design or by altering the soil at the site.

This Watonga soil is in capability subclass IIIw and in the Heavy Bottomland range site.

62—Watonga silty clay loam, rarely flooded. This deep, moderately well drained soil is on the flood plain of the Washita River. Areas of this soil are rarely flooded. The soil is nearly level with some concave areas. Individual areas range from 20 to 160 acres.

Typically, the surface layer is dark gray silty clay loam about 18 inches thick. The subsoil is dark grayish brown silty clay to a depth of about 46 inches. The underlying material is dark brown silty clay.

This soil is high in natural fertility and organic matter content. The surface layer is neutral to moderately alkaline, and the subsoil is moderately alkaline. The rate of water movement through the soil is very slow, and the available water capacity is high. The root zone is deep and is somewhat restricted by the clayey subsoil.

Included with this soil in mapping are small areas of McLain soils. These included soils make up about 10 percent of the map unit. Separate areas of included soils are generally less than 2 acres.

Areas of this Watonga soil are used for cropland. A very minor acreage is in tame pasture.

This soil has high potential for growing most locally adapted crops, but the soil texture and permeability are limiting factors for crop yields. Management concerns for crops are maintaining soil tilth and fertility. Adding fertilizer helps to increase plant growth, which provides more crop residue to help maintain soil tilth and fertility.

The soil has high potential for native grass and tame pasture. Bermudagrass or weeping lovegrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of the grass. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has low potential for most urban uses. Flooding and shrinking and swelling are limitations for dwellings, small commercial buildings, and roads and streets. Very slow permeability is the limitation on septic tank absorption fields. The soil is clayey, which is a limitation for trench type sanitary landfills. Most of these limitations are difficult and expensive to overcome, but they can be overcome by proper design or by altering the soil at the site.

This Watonga soil is in capability subclass IIIw and in the Heavy Bottomland range site.

63—Wilson silt loam, 0 to 1 percent slopes. This deep, somewhat poorly drained, nearly level soil occurs in the central and southeastern parts of the county. It formed in alkaline, clayey, old alluvium or nearly impervious marine clay. Slopes are simple. Individual areas range from 5 to 50 acres.

Typically, the surface layer is gray silt loam about 8 inches thick. The upper part of the subsoil is dark gray silty clay loam to a depth of about 24 inches. The lower part of the subsoil is light gray silty clay to a depth of about 44 inches. The underlying material is light gray silty clay.

This soil is medium to high in natural fertility and organic matter content. It is slightly acid or neutral in the upper part and neutral to moderately alkaline in the lower part of the soil. The rate of water movement through the soil is very slow, and the available water capacity is high. The root zone is deep and is somewhat restricted by the clayey subsoil. This soil has a perched water table in the upper 12 inches of the soil for short periods during the winter and spring.

Included with this soil in mapping are small areas of Durant soils. Also included in some mapped areas are areas of Gasil soils. These included soils make up about 10 percent of this map unit. Separate areas of included soils are generally less than 2 acres.

This soil is used mainly for tame pasture. Some areas are cultivated to forage sorghums. A minor acreage is used for range.

This soil has medium potential for cropland. Management concerns for crops are wetness and maintaining soil tilth and fertility. Adding fertilizer helps to increase plant growth, which provides more crop residue to help maintain soil tilth and fertility. Minimum tillage and the use of crop residue help to control soil erosion. Winter cover crops furnish additional soil protection against wind and water erosion.

The soil has medium potential for native grass and tame pasture. Bermudagrass or weeping lovegrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has low potential for most urban uses. Shrinking and swelling and wetness are limitations for dwellings, small commercial buildings, and roads and streets. Very slow permeability and wetness are limitations for septic tank absorption fields. The clayey subsoil and wetness limit trench type sanitary landfills. Most of these limitations can be overcome by proper design or by altering the soil.

This Wilson soil is in capability subclass IIIw and in the Claypan Prairie range site.

64—Yahola fine sandy loam, occasionally flooded. This deep, well drained soil is on the flood plain of the Washita River. Areas of this soil are occasionally flooded. The soil is nearly level and convex to concave. Individual areas are from 5 to 150 acres.

Typically, the surface layer is brown and yellowish red fine sandy loam about 18 inches thick. The upper part of the underlying material is reddish yellow fine sandy loam and has thin strata of silt loam to a depth of about 50 inches. The lower part of the underlying material is reddish brown silt loam.

This soil is medium to high in natural fertility and low in organic matter content. The surface layer is mildly alkaline or moderately alkaline, and below this the soil is moderately alkaline. The rate of water movement through the soil is moderately rapid, and the available water capacity is medium. The root zone is deep and is favorable for root growth. This soil has good tilth and can be worked throughout a wide range of moisture content.

Included with this soil in mapping are small areas of Dale soils. The included soils make up about 10 percent of the map unit. Separate areas of included soils are generally less than 2 acres.

Areas of this Yahola soil are used mainly for tame pasture and hayland. Some areas are cultivated for forage sorghum and alfalfa.

This soil has high potential for cropland. Maintaining soil fertility is a management concern for crops. Adding fertilizer helps to increase plant growth, which provides more crop residue to help maintain soil tilth and fertility.

The soil has high potential for native grass and tame pasture. Bermudagrass or weeping lovegrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of grass. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has low potential for most urban uses. Flooding is the main limitation for septic tank absorption fields, dwellings, small commercial buildings, and roads and streets. Flooding is a limitation for sewage lagoons, and seepage is a limitation for trench type sanitary landfills. These limitations are difficult and expensive to overcome.

This Yahola soil is in capability subclass IIw and in the Loamy Bottomland range site.

65—Yahola loamy fine sand, frequently flooded. This deep, well drained soil is on the lowest flood plain adjacent to the Washita River channel. Areas of this soil are frequently flooded. The soil is nearly level and concave to convex. Individual areas are 50 to 200 feet wide and several miles long.

Typically, the surface is yellowish red loamy fine sand about 18 inches thick. The underlying material is reddish yellow fine sandy loam that has thin strata of silt loam.

This soil is medium to high in natural fertility and low in organic matter content. It is moderately alkaline and calcareous throughout. The rate of water movement through the soil is moderately rapid, and the available water capacity is medium. The root zone is deep and is favorable for most root growth. This soil has good tilth and can be worked throughout a wide range of moisture content.

Included with this soil in mapping are soils that have yellowish red silt loam over loamy very fine sand with silt loam strata. Also included are soils that are silty clay or clay and that remain wet most of the year. These included soils are in old river channels, and they make up about 15 percent of the map unit. Separate areas of included soils are generally less than 1/2 acre.

Areas of this Yahola soil are used mainly for tame pasture. Some areas are used for range.

This soil has low potential for cropland. Flooding is the main limitation.

The soil has high potential for native grass and tame pasture. Bermudagrass or weeping lovegrass and clovers are commonly used in tame pasture. Fertilizing tame pasture increases the amount of forage and improves the quality of the grass. The added plant growth protects the soil from erosion. The quality of native and tame pasture grasses also can be improved by controlling grazing, proper stocking, and preventing fires.

This soil has low potential for most urban uses. Flooding is the main limitation for septic tank absorption fields, dwellings, small commercial buildings, and roads and streets. Flooding is a limitation for sewage lagoons, and seepage is a limitation for trench type sanitary landfills. These limitations are difficult and expensive to overcome.

This Yahola soil is in capability subclass Vw and in the Sandy Bottomland range site.

Prime Farmland

Prime farmland is one of several kinds of important farmlands defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. The supply of high quality farmland is limited, and the U.S. Department of Agriculture recognizes that all levels of government, as well as individuals, must intelligently encourage and facilitate the use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to producing food, feed, forage, fiber, and oilseed crops. It has the soil quality, growing season, and moisture supply needed to economically produce a sustained high yield of crops if it is treated and managed using acceptable farming methods. Prime farmland produces high yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland must either be used for producing food or fiber or be available for these uses. It may now be in crops, pasture, woodland, or other land, but not urban and built-up land or water areas. Urban and built-up areas are any contiguous unit of land, 10 acres or more in size, that is used for residences, industrial sites, commercial sites, public administrative sites, railroad yards, small parks, cemeteries, airports, golf courses, sanitary landfills, sewage treatment plants, water control structures and spillways, or other similar uses.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. It also has favorable temperature and growing season and acceptable soil reaction. It has few or no rocks and is permeable to water and air. Prime farmland is not excessively erodible or saturated with water for long periods, and it is not frequently flooded during the growing season. The slope ranges mainly from 0 to 5 percent. For more detailed information on the criteria for prime farmland consult the local staff of the Soil Conservation Service.

In Murray County about 53,886 acres, or 19.7 percent, is prime farmland. Areas of prime farmland are scattered throughout the county, but most are in the central and northwestern parts, mainly in general soil map units 1, 2, 3, 4, 6, 7, and 8. Approximately 25 percent of this prime farmland is in field crops, 65 percent is tame pasture, and 10 percent is rangeland. Crops are mainly grain sorghums, wheat, oats, corn, alfalfa, peanuts, and soybeans.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and difficult to cultivate, and usually less productive.

Soil map units that make up prime farmland in Murray County are listed in this section. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps in the back of this publication. The soil qualities that affect use and management of each map unit are described in the section "Detailed Soil Map Units." The soil map units in this list are prime farmland except where the use is urban or built-up land.

The map units that constitute prime farmland in Murray County are—

1 Bastrop fine sandy loam, 1 to 3 percent slopes
6 Burleson clay, 1 to 3 percent slopes
8 Chigley gravelly sandy loam, 1 to 5 percent slopes
18 Dale silt loam, rarely flooded
19 Durant loam, 0 to 1 percent slopes
20 Durant loam, 1 to 3 percent slopes
24 Elandco silt loam, occasionally flooded
26 Fitzhugh loam, 1 to 3 percent slopes
29 Garvin silty clay, occasionally flooded
33 Gasil fine sandy loam, 1 to 3 percent slopes
34 Gasil Variant shaly silt loam, 2 to 5 percent slopes
40 Konawa fine sandy loam, 0 to 2 percent slopes
41 Konsil fine sandy loam, 3 to 5 percent slopes
42 Lula silt loam, 1 to 3 percent slopes
43 McLain silty clay loam, rarely flooded
44 Norge Variant silt loam, 1 to 3 percent slopes
48 Renfrow silt loam, 1 to 3 percent slopes
49 Renfrow silt loam, 3 to 5 percent slopes
53 Stephenville Variant fine sandy loam, 3 to 5 percent slopes
55 Teller loam, 0 to 1 percent slopes
56 Teller loam, 1 to 3 percent slopes
61 Watonga clay, rarely flooded
62 Watonga silty clay loam, rarely flooded
64 Yahola fine sandy loam, occasionally flooded

Use and Management of the Soils

Earl G. Weisner, district conservationist, Soil Conservation Service, assisted in preparing this section.

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

Keith Vaughan and Jimmy D. Altom, conservation agronomists, Soil Conservation Service, helped to prepare this section.

More than 80,000 acres in Murray County was used for crops and pasture in 1974, according to the Soil Conservation Service land use inventory. Of this total, 60,000 acres was used for pasture, 5,000 acres for row crops, 12,000 acres for close-growing crops, mainly wheat and oats, and 3,000 acres for rotation hay and pasture.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

Crops

The soils in Murray County have good potential for increased production of food. Some potentially good cropland is currently used as rangeland or pastureland. Food production can be increased by using the latest crop production technology on all cropland in the survey area. This soil survey can help to facilitate the application of such technology.

The acreage in cropland and woodland has gradually decreased as more and more land is used for urban structures. In 1974, about 4,700 acres was used as urban and built-up land in the survey area. This figure has been increasing at the rate of about 20 acres per year.

Field crops suited to the soils and climate of the survey area include many that are now not commonly grown. Peanuts, grain sorghum, and soybeans are the main row crops. Cotton and similar crops can be grown if economic conditions are favorable. Wheat is the common close-growing crop. Rye and oats also can be grown, and plains bluestem and weeping lovegrass seed can be produced. Alfalfa and bermudagrass are the most common hay crops.

Specialty crops grown in the survey area are vegetables, small fruits, tree fruits, and nursery plants. A small acreage throughout the survey area is used for melons, strawberries, sweet corn, tomatoes, peppers, and other vegetables and small fruits. Pecans are the most important specialty crop grown in the survey area.

Soil erosion is a major concern on the cropland in Murray County. If slope is more than 1 percent, erosion is a hazard. Loss of the surface layer through erosion is damaging for two reasons. First, as the surface layer is lost and part of the subsoil is incorporated into the plow layer, productivity is reduced. Loss of the surface layer is especially damaging on soils that have a clayey subsoil, such as Durant, Renfrow, Clarita, and Tussy soils. Second, soil erosion results in sedimentation of streams. Control of erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

A cropping system that keeps vegetative cover on the soil for extended periods can hold soil erosion losses to amounts that will maintain the productive capacity of the soils. Conservation tillage that leaves crop residue on the surface helps to increase infiltration and reduces the hazards of runoff and erosion.

Terraces and diversions reduce the length of slope and reduce runoff and erosion. They are not practical, however, on deep, sandy soils. Durant soils, for example, are suitable for terraces. Claremore soils are less suitable for terraces and diversions because bedrock is at a depth of less than 20 inches.

Contouring and contour stripcropping are used effectively to control erosion in the survey area. They are best adapted to soils that have smooth, uniform slopes. This includes most areas of Durant, Bastrop, Teller, Lula, Chigley, and Fitzhugh soils.

Soil blowing is a hazard on Eufaula loamy fine sand in some areas. Soil blowing can damage this soil if winds are strong and the soil is dry and bare of vegetation or surface mulch. Maintaining a vegetative cover, surface mulch, or rough surfaces through tillage minimizes soil blowing.

Information for the design of erosion control plans for each kind of soil is available in local offices of the Soil Conservation Service.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6.

The capability classification of each map unit is given in the section "Detailed Soil Map Units."

Pastureland

About 22 percent of the acreage in the county is used as pastureland. The long-term trend is to convert cropland to pasture (fig. 7). To a lesser degree, range is also converted to pasture.

The principal pasture grass is improved bermudagrass. Some of the better pastures of bermudagrass are overseeded with legumes, which increase the quality and quantity of forage and provide additional plant food. Some bermudagrass pastures are overseeded with fescue. This forage mixture is especially adapted to soils on flood plains where additional moisture is available.

Fescue is an important grass in the county. It provides a sufficient quantity of forage for grazing on soils that have adequate available moisture. Fescue is used in the pasture program with other forage to furnish grazing and additional protein late in fall and in spring. To maintain a vigorous stand, it needs to be fertilized early in spring and early in fall, and it should not be grazed during summer.

Weeping lovegrass is grown on a few acres in the county. It is a warm season, perennial bunchgrass suited to well drained, loamy and sandy soils. It begins growth earlier in the spring than bermudagrass and remains green later in the fall. It responds well to fertilizer, especially nitrogen. It becomes less palatable to cattle as it matures, however.

Some areas of cropland are used to grow forage plants that supplement the permanent grasses. Small grains in the pasture program provide grazing and additional protein for livestock late in fall and in spring. Small grains need to be seeded late in August or in September and adequately fertilized to obtain maximum forage. Small grains can be grazed until maturity, or livestock can be removed in spring to allow the plants to grow a seed crop for harvest. Wheat, oats, barley, and rye are the main small grains used for grazing.

Forage sorghum, an annual grass, is used on some cropland areas to supplement permanent grasses. Forage sorghum can be used in the pasture program to provide grazing during summer, or it can be harvested for hay. In some areas, forage sorghum is allowed to grow until frost and is grazed in the winter. Fertilizer helps to obtain maximum growth.

Plains bluestem is grown in a few acres in the county. It is a warm season, perennial tall grass suited to well drained, loamy and clayey soils. Plains bluestem begins growth earlier in the spring than bermudagrass, and it remains palatable to cattle as it matures later than does lovegrass. It also responds very well to fertilization. Plains bluestem is capable of producing two seed crops per year in a normal year.

Pasture management. The kinds of soil and suitable plants must be considered in tame pasture management. Good pastures can be achieved by managing to maintain the desired kind and stand of plants. Plants must have vigor to keep a proper balance in the stand. Grazing needs to be compatible with the growth of plants.

Proper grazing and rotation grazing help to lengthen the life of most tame pasture plants. Deferred grazing during the time that tame pasture plants are under the most stress is beneficial. This allows the plants to regain vigor by helping to maintain a large root system where food can be stored for the next growing season. Total production of forage will increase.

Fertilizer that contains the proper elements contributes to more vigorous pasture plants. This helps to increase the amount of forage and lengthen the lifespan of the plants. Plant food can be added by using commercial fertilizers or legumes, or both, that furnish nitrogen to the plants. The acidity of the soil needs to be adjusted to the kinds of plants desired in the stand. Large amounts of plant food, especially nitrogen, are needed if legumes are not grown with the grass.

Desirable pasture plants are more productive if the invasion of undesirable plants is controlled. Brush control is essential on soils on which trees grow.

Planning a pasture program. A pasture program can be planned so that forage will be available during every month of the year. A study of the growth habits of the different plants is necessary to ensure adequate forage each month. The percentage of total plant growth per month for various forage plants is shown in figure 8. For example, bermudagrass accomplishes 33 percent of its yearly growth for grazing during the month of June.

Soils vary in their capacity to produce forage for grazing. Durant soil produces more forage than Claremore soil, primarily because it furnishes more available moisture to the plant. The total yearly production of common pasture plants for each soil is given in animal unit months (AUM) in table 6. For example, bermudagrass on Durant loam, 1 to 3 percent slopes, will furnish grazing for one animal unit for 6 months during the year.

A well planned pasture program must consider the total yearly production of the pasture plant and the growth the plant will make for a particular month (fig. 8). For example, bermudagrass furnishes 33 percent of its annual forage growth during June. Yearly production of bermudagrass on Durant loam, 1 to 3 percent slopes, is 6 AUM. Since 33 percent times 6 AUM equals 2 AUM, one acre of this Durant soil provides sufficient grazing for 2 animals in June. A 50-acre pasture of bermudagrass on Durant loam, 1 to 3 percent slopes, therefore, would furnish grazing for 100 animals during June.

Help in planning a pasture program can be obtained from local offices of the Soil Conservation Service or County Extension Office.

Rangeland

Ernest C. Snook, range conservationist, Soil Conservation Service, helped to prepare this section.

Rangeland is land on which the native vegetation is a variety of grasses, grasslike plants, forbs, shrubs, and trees. The vegetation is generally suitable for grazing and occurs in sufficient amount to be used for grazing.

Figure 7.—Pasture in a formerly cultivated area of Durant loam, 2 to 5 percent slopes, eroded. This soil can produce a high amount of King Ranch bluestem forage.

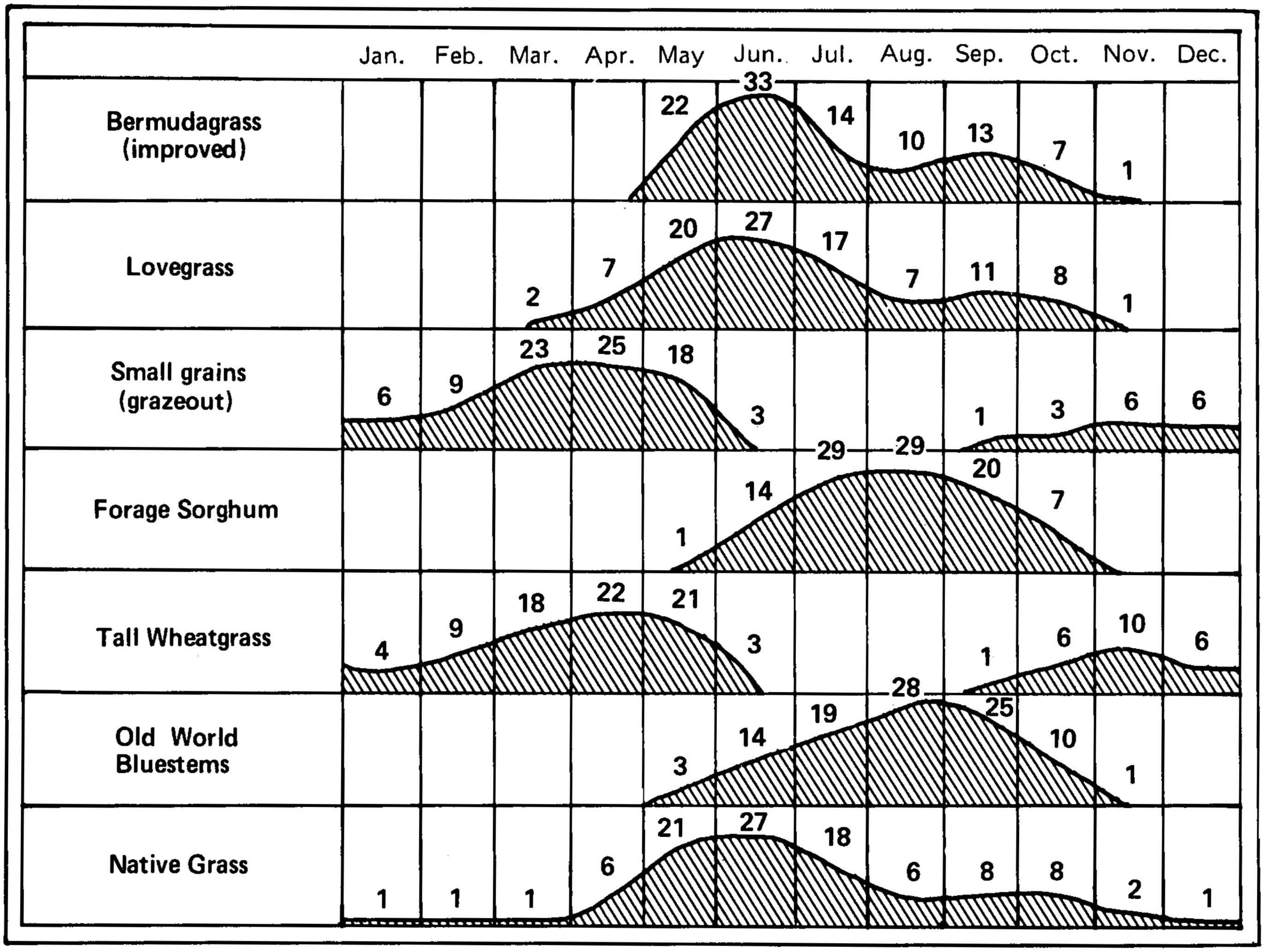


Figure 8.—A forage calendar showing the monthly distribution of growth (as a percentage of annual forage growth).

Rangeland, or native grassland, does not receive regular or frequent cultural treatment. The composition and production of the plant community is determined by the soil, climate, topography, overstory canopy, and grazing management.

According to records of the local field office of the Soil Conservation Service, 54 percent of Murray County is rangeland. About 50 percent of farm income is derived from livestock. Rangeland originally produced a wide variety of tall and mid grasses interspersed with abundant forbs.

In the eastern part of the county, in the Mill Creek and Pennington Creek watersheds, most of the soils are loamy and deep to shallow over limestone and sandstone. These soils support mid and tall grasses, and potential productivity is high on the moderately deep and deep soils. In the north-central part of the county, the soils are deep with a clayey or loamy surface layer. These soils have high potential for mid and tall grasses. In the extreme northern part, at higher elevations, loamy soils support a post oak and blackjack oak savannah that has an understory of mid and tall grasses. In the western and extreme southeastern parts of the county, the shallow, stony and loamy soils are on low hills and mountains. These soils support mid grasses and some short grasses with a considerable amount of juniper; they have low potential for rangeland. Deep soils on the toe slopes of the mountains support hardwoods with an understory mostly of mid grasses. Along the Washita River and its tributaries, most of the soils are deep and loamy or clayey. These soils have been cleared of hardwoods and are presently cultivated throughout most of the area. Small areas of native vegetation have high potential for producing tall grasses.

The vegetative community of Murray County rangeland has changed drastically over the past 50 years. Heavy grazing has deteriorated much of the grasslands, and much of the high quality vegetation has been grazed out. Now, tall grasses flourish in only a few places. Areas in the western part of the county, once open grassland, are now covered with juniper and a mixture of short and mid grasses and poor quality forbs. The amount of forage presently produced may be less than half of that originally produced. However, remnants of the original plant species still are found in protected areas on most grasslands, and, in most cases, good grazing management will allow these high-quality plants to reestablish themselves.

Although most of the local ranches and livestock farms are cow-calf operations, there are some stocker calf enterprises, and many ranches supplement their herds with stockers. This provides flexibility for adjusting the number of livestock to be cared for in periods of drought.

Livestock operations generally supplement the grazing of native grassland with the grazing of pastureland and cropland. Improved bermudagrass and weeping lovegrass are commonly grown introduced pasture grasses. Protein supplement, hay, and grazing of small grain are used to supplement livestock feeding throughout the winter.

Approximately 75 percent of the annual growth of forage takes place in April, May, and June, when spring rains and moderate temperatures favor the growth of warm-season plants. A secondary growth period generally occurs in September and October, when fall rains and gradually cooling temperatures are common.

Droughts of varying length are frequent. Each year, a short midsummer drought normally occurs. Longer periods of drought sometimes last for several months.

Range Sites

Table 7 shows, for each soil, the range site and the total annual production of vegetation in favorable, normal, and unfavorable years. Only those soils that are used as or are suited to rangeland are listed. Explanation of the column headings in table 7 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community, which differs from other natural plant communities in kind, amount, and proportion of range plants. The relationship between the soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the growth and productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Potential forage production depends on the range site. Current forage production depends on the range condition and the moisture available to plants during the growing season.

Potential annual production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre reduced to a common percent of air-dry moisture.

Range Condition Classes

Climax vegetation is the stabilized plant community that a range site is capable of producing. It consists of the plants that were growing there when the region was first settled. This climax plant community reproduces itself and changes very little, as long as the environment remains unchanged. If cultivated crops are not grown, the most productive combination of forage plants on a range site is generally the climax vegetation.

Decreasers, or *preferred forage plants*, are plants in the climax vegetation that tend to decrease in relative amount under close grazing. They generally are the tallest and most productive perennial grasses and forbs, and they are the most palatable to livestock. Increasers, or *desirable forage plants*, are plants that increase in relative amount as the more desirable decreaser plants are reduced by close grazing. They are commonly shorter than decreasers, and they are generally less palatable to livestock. Invaders, or *undesirable forage plants*, are plants that cannot compete in the climax plant community for moisture, nutrients, and light. However, invaders grow along with increasers after the grazing value of the climax vegetation has been reduced. Some invaders have little value for grazing.

Range condition is judged according to the standards that apply to the particular range site. It expresses the present kind and amount of vegetation in relation to the climax plant community for that site. Four range condition classes are used to indicate the degree of departure from the potential, or climax, vegetation. A range is in excellent condition if 76 to 100 percent of the vegetation is of the same kind as that in the climax stand; in good condition if the percentage is 51 to 75; in fair condition if the percentage is 26 to 50; and in poor condition if the percentage is 25 or less.

A primary objective of good range management is to maintain range in excellent or good condition. On a well managed range, water is conserved, yields are improved, and the soils are protected. The main management concern is recognizing important changes in the kind of cover on a range site. These changes take place gradually and can be misinterpreted or overlooked. Growth encouraged by heavy rainfall may lead to the conclusion that the range is in good condition, whereas actually the cover is weedy and the long-term trend is toward lower production. On the other hand, rangeland that has been closely grazed for short periods under the supervision of a careful manager may have a degraded appearance that temporarily conceals its quality and ability to recover. Years of prolonged overuse of rangeland can eliminate the seed sources of desirable vegetation. If this happens, the vegetation needs to be reestablished for management to be effective.

Range management practices that are important for Murray County are proper grazing use, deferred grazing, and a planned grazing system. Other beneficial practices are stock water development, fencing, and proper location of salting and feeding facilities. When regression has occurred or is occurring, and undesirable plants dominate, such accelerating practices as range seeding, brush management, weed management, and prescribed burning should be considered, singly or in combination with management or facilitating practices.

These practices, properly applied and maintained, generally result in the optimum production of vegetation, reduction of undesirable species, conservation of water, and control of erosion. Sometimes a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Potential Annual Utilization

The following guidelines are for potential annual utilization on a broad scale. Consult the Soil Conservation Service for more detailed information on a particular area or situation.

To maintain or improve the quality and quantity of native vegetation, the amount of removal needs to be adjusted based on the potential productivity and condition of the site. As a rule of thumb, approximately 50 percent of the annual season's growth should be left on the soil surface. About one-third of the height of tall and mid grasses equals 50 percent of annual production at maturity.

If 50 percent of annual season growth remains on the site, the balance of nature protects the natural resources of soil, plant, animal, and environment. The other 50 percent of annual season growth may or may not be removed from the site. The removal can be in a number of ways, such as by rodents, insects, or mammals or by deterioration due to climatic variations.

Generally, livestock will account for about one-half of the growth that is removed from the site, or about 25 percent of the total annual growth, by weight. If, for example, the forage available on a specific range site is 3,500 pounds of air-dry vegetative material per acre in an average growing season, then about 875 pounds (25 percent) is available for livestock forage. A 1,000 pound cow (equivalent to one animal unit) consumes about 2-1/2 to 3 percent of its body weight of forage per day. If one animal unit consumes 25 to 30 pounds of forage per day, in one month (30 days) an animal unit requires from 750 to 900 pounds of native vegetation forage. The amount consumed will vary depending on the quality of the forage and its stage of growth.

Dividing the available 875 pounds of forage production by the 25 to 30 pounds required per day by one animal unit shows that one acre of the range site in question can produce sufficient forage to sustain one animal unit for 29 to 35 days.

To convert the available forage production from one acre into animal unit months (AUM), divide the available forage (875 pounds) by the monthly requirement of one animal unit (750 to 900 pounds). Thus, in the example given, one acre of the range site in question would produce between 0.97 AUM and 1.17 AUM. To sustain an animal unit on that range site for a full year would require from 10.3 to 12.3 acres.

Range Site Plant Communities

There are 17 range sites in Murray County. The following paragraphs describe the common preferred, desirable, and undesirable plants for each range site.

Blackclay Prairie range site. The Burleson and Clarita soils in map units 6, 15, 16, and 51 are in this range site. The potential plant community is a mid-tall grass aspect. Species composition, by weight, is 95 percent grasses, 4 percent forbs, and 1 percent woody plants.

Big bluestem, little bluestem, indiangrass, switchgrass, eastern gamagrass, leadplant, compassplant, and Maximilian sunflower are preferred plants; they make up 80 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear under continuous heavy grazing and are replaced by desirable plants, such as meadow dropseed, tall dropseed, sideoats grama, buffalograss, hairy grama, Texas wintergrass, scurfpea, and heath aster.

Continued overgrazing and extreme climatic conditions can cause a decline in the desirable plants. If this occurs, undesirable plants, such as silver bluestem, Texas grama, windmillgrass, annual grasses, western ragweed, common broomweed, basketflower, ironweed, mesquite, and persimmon, gradually dominate the site. As the undesirable plants increase, the potential forage production is reduced.

Breaks range site. The Kiti soil in map unit 50 is in this range site. The potential plant community varies from a mid and tall grass to a short and mid grass aspect. Species composition, by weight, is 91 percent grasses, 4 percent forbs, and 5 percent woody plants. The woody vegetation is along and just below escarpments.

Big bluestem, indiangrass, switchgrass, little bluestem, Jersey tea, prairie-clover, Maximilian sunflower, and Pitcher sage are preferred plants; they make up 60 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear under continuous heavy grazing and are replaced by desirable plants, such as sideoats grama, dropseeds, purpletop, panicums, hairy grama, silver bluestem, muhly, scurfpea, heath aster, sagewort, goldenrod, greenbrier, dogwood, soapweed, sumac, hawthorn, and oaks.

Continued overgrazing and extreme climatic conditions can cause a decline in the desirable plants. If this occurs, undesirable plants, such as splitbeard bluestem, broomsedge bluestem, threeawns, annual bromes, common broomweed, ironweed, and bitter sneezeweed, gradually dominate the site. As undesirable plants increase, the potential forage production is reduced.

Claypan Prairie range site. The Renfrow and Wilson soils in map units 48, 49, and 63 are in this range site. The potential plant community is a mid-tall grass aspect. Species composition, by weight, is 96 percent grasses and 4 percent forbs.

Big bluestem, indiangrass, switchgrass, little bluestem, vine-mesquite, western wheatgrass, dotted gayfeather, and perennial sunflowers are preferred plants; they make up 60 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear under continuous heavy grazing and are replaced by desirable plants, such as sideoats grama, blue grama, silver bluestem, lovegrasses, dropseeds, buffalograss, Texas grama, fall witchgrass, neptunia, scurfpea, sagewort, ragweed, goldaster, and gumweed.

Continued overgrazing and extreme climatic conditions can cause a decline in the desirable plants. If this occurs, undesirable plants, such as threeawns, annual cool-season grasses, broomweed, gaillardia, pricklypear cactus, and mesquite, gradually dominate the site. As undesirable plants increase, the potential forage production is reduced.

Deep Sand Savannah range site. The Eufaula soil in map unit 25 is in this range site. The potential plant community species composition, by weight, is 85 percent grasses, 5 percent forbs, and 10 percent woody plants.

Big bluestem, indiangrass, switchgrass, little bluestem, broadleaf uniola, beaked panicum, wildrye, lespedeza, and grape are preferred plants; they make up 80 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear under continuous heavy grazing and are replaced by desirable plants, such as purpletop, dropseeds, sideoats grama, lovegrasses, Scribner panicum, fringeleaf paspalum, sagewort, snakecotton, beebalm, oak, and skunkbush sumac.

Continued overgrazing and extreme climatic conditions can cause a decline in the desirable plants. The spaces vacated fill in with oak sprouts. In this condition, this site is sometimes mistakenly classified as forest land. If regression occurs, undesirable plants, such as broomsedge bluestem, splitbeard bluestem, annual threeawn, annual brome, showy partridgepea, ragweeds, white snakeroot, silver bluestem, lovegrass, camphorweed, annual wild buckwheat, and horseweed fleabane, gradually dominate the site. As undesirable plants increase, the potential forage production is reduced.

Edgerock range site. The Kiti soils in map units 37, 38, and 39 are in this site. The potential plant community is a mid-tall grass aspect. Species composition, by weight, is 94 percent grasses, 4 percent forbs, and 2 percent woody plants.

Big bluestem, indiangrass, switchgrass, little bluestem, wildrye, sensitivebrier, gayfeather, perennial sunflower, blacksamson, and prairie rose are preferred plants; they make up 60 percent of livestock forage production if the range is in exellent condition. The preferred plants disappear under continuous heavy grazing and are replaced by desirable plants, such as sideoats grama, purpletop, dropseed, silver bluestem, hairy grama, tall grama, purple threeawn, scurfpea, heath aster, goldenrod, hackberry, elm, sumac, and greenbrier.

Continued overgrazing and extreme climatic conditions can cause a decline in the desirable plants. If this occurs, undesirable plants, such as annual bromes, annual threeawn, hairy tridens, Texas grama, windmillgrass, tumblegrass, common yarrow, puffsheath dropseed, common broomweed, ragweeds, juniper, hawthorn, and pricklypear cactus, gradually dominate the site. As undesirable plants increase, the potential forage production is reduced.

Eroded Prairie range site. The Clarita, Durant, and Fitzhugh soils in map units 12, 22, and 28 are in this range site. Most of this site was formerly cultivated land. The potential plant community is a mid-tall grass aspect. Species composition, by weight, is 96 percent grasses, 3 percent forbs, and 1 percent woody plants.

Little bluestem, indiangrass, and some switchgrass, big bluestem, prairie-clover, tickclover, scurfpea, sensitivebrier, gayfeather, perennial sunflower, and skunkbush are preferred plants; they make up 60 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear under continuous heavy grazing and are replaced by desirable plants, such as dropseeds, sideoats grama, hairy grama, silver bluestem, Scribner panicum, scurfpea, dalea, heath aster, goldenrod, coralberry, sumac, and blackberry.

Continued overgrazing and extreme climatic conditions can cause a decline in the desirable plants. If this occurs, undesirable plants, such as splitbeard bluestem, broomsedge bluestem, threeawn, annual bromes, common broomweed, ragweeds, persimmon, and oak, gradually dominate the site. As undesirable plants increase, the potential forage production is reduced.

Eroded Sandy Savannah range site. The Bastrop, Konawa, Chigley, and Gasil soils in map units 5, 12, and 32 are in this range site. The site is formerly cultivated and severely eroded, sandy soils on uplands. The potential plant community species composition, by weight, is 94 percent grasses, 3 percent forbs, and 3 percent woody plants.

Little bluestem, indiangrass, and some switchgrass, big bluestem, tickclover, Illinois bundleflower, prairie-clover, ashy sunflower, and Pitcher sage are preferred plants; they make up 60 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear under continuous heavy grazing and are replaced by desirable plants, such as sideoats grama, purpletop, tall dropseed, fall witchgrass, purple lovegrass, heath aster, and prairie sagewort.

Continued overgrazing and extreme climatic conditions can cause a decline in the desirable plants. If this occurs, undesirable plants, such as silver bluestem, splitbeard bluestem, threeawns, lovegrasses, sand dropseed, western ragweed, ironweed, post oak, blackjack oak, sumac, coralberry, and persimmon gradually dominate the site. As undesirable plants increase, the potential forage production is reduced.

Granite Hills range site. The Timhill soil in map unit 57 is in this range site. The potential plant community species composition, by weight, is 95 percent grasses, 4 percent forbs, and 1 percent woody plants.

Little bluestem, indiangrass, big bluestem, switchgrass, Canada wildrye, prairie acacia, yellow neptunia, halfshrub sundrop, fringeleaf ruellia, and Pitcher sage are preferred plants; they make up 50 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear under continuous heavy grazing and are replaced by desirable plants, such as sideoats grama, hairy grama, blue grama, buffalograss, meadow dropseed, wildindigo, bigtop dalea, scarlet globemallow, gayfeather, nailwort, greenthread, small soapweed, live oak, post oak, blackjack oak, and skunkbush.

Continued overgrazing and extreme climatic conditions can cause a decline in the desirable plants. If this occurs, undesirable plants, such as silver bluestem, sand dropseed, lovegrasses, fall witchgrass, western ragweed, brown snakeweed, pricklypear cactus, and numerous weedy grasses and forbs, gradually dominate the site. As undesirable plants increase, the potential forage production is reduced.

Heavy Bottomland range site. The Garvin, McLain, and Watonga soils in map units 29, 30, 43, 61, and 62 are in this range site. The potential plant community species composition, by weight, is 95 percent grasses, 3 percent forbs, and 2 percent woody plants.

Switchgrass, prairie cordgrass, eastern gamagrass, Virginia wildrye, vine-mesquite, broadleaf uniola, rosinweed, and perennial sunflowers are preferred plants; they make up 70 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear under continuous heavy grazing and are replaced by desirable plants, such as tall dropseed, purpletop, longspike tridens, white tridens, buffalograss, knotroot bristlegrass, Texas wintergrass, sedges, wild alfalfa, heath aster, goldenrod, greenbrier, roughleaf dogwood, elm, oak, and sumac.

Continued overgrazing and extreme climatic conditions can cause a decline in the desirable plants. If this occurs, undesirable plants, such as windmillgrass, tumblegrass, broomsedge bluestem, silver bluestem, threeawn, annual brome, curly dock, seacoast sumpweed, ragweeds, cocklebur, ironweed, white snakeroot, pecan, persimmon, and mesquite, gradually dominate the site. As undesirable plants increase, the potential forage production is reduced.

Loamy Bottomland range site. The Dale, Elandco, and Yahola soils in map units 18, 24, 30, and 64 are in this range site. The potential plant community is a tall (warm season) and mid (cool season) grass aspect. Species composition, by weight, is 93 percent grasses, 3 percent forbs, and 4 percent woody plants.

Big bluestem, switchgrass, indiangrass, eastern gamagrass, little bluestem, wildryes, western wheatgrass, tickclover, Illinois bundleflower, perennial sunflowers, wholeleaf rosinweed, poison-ivy, and grape are preferred plants; they make up 80 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear under continuous heavy grazing and are replaced by desirable plants, such as tall dropseed, purpletop, sideoats grama, knotroot bristlegrass, sedges, Texas bluegrass, heath aster, goldenrod, prairie sagewort, and, along streambanks, elm, pecan, oak, cottonwood, green ash, redbud, roughleaf dogwood, greenbrier, and coralberry.

Continued overgrazing and extreme climatic conditions can cause a decline in the desirable plants. If this occurs, undesirable plants, such as silver bluestem, windmillgrass, tumblegrass, dropseeds, buffalograss, broomsedge bluestem, trailing wildbean, camphorweed, ragweeds, ironweed, mesquite, black willow, and hawthorn, gradually dominate the site. As undesirable plants increase, the potential forage production is reduced.

Loamy Prairie range site. The Catoosa, Claremore, Durant, Fitzhugh, Kingfisher Variant, Scullin, Lula, Norge Variant, and Teller soils in map units 7, 13, 19, 20, 21, 26, 27, 36, 39, 42, 44, 55, and 56 are in this range site. The potential plant community is a tall grass aspect. Species composition, by weight, is 96 percent grasses, 3 percent forbs, and 1 percent woody plants.

Big bluestem, indiangrass, switchgrass, little bluestem, wildrye, leadplant, prairie acacia, sensitivebrier, perennial sunflower, Engelmann-daisy, compassplant, and prairie rose are preferred plants; they make up 80 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear under continuous heavy grazing and are replaced by desirable plants, such as tall dropseed, meadow dropseed, sideoats grama, Scribner panicum, blue grama, fall witchgrass, jointtail, wildindigo, wild alfalfa, heath aster, prairie sagewort, goldenrod, elm, coralberry, greenbrier, and sumac.

Continued overgrazing and extreme climatic conditions can cause a decline in the desirable plants. If this occurs, undesirable plants, such as silver bluestem, splitbeard bluestem, broomsedge bluestem, windmillgrass, threeawn, annual brome, common broomweed, western ragweed, plantain, mesquite, and persimmon gradually dominate the site. As undesirable plants increase, the potential forage production is reduced.

Red Clay Prairie range site. The Tussy soils in map units 59 and 60 are in this range site. The potential plant community is a mid and tall grass aspect. Species composition, by weight, is 97 percent grasses and 3 percent forbs.

Little bluestem, big bluestem, indiangrass, prairie-clover, trailing ratany, prairie bundleflower, gayfeathers, Engelmann-daisy, perennial sunflower, prairie sunflower, and prairie rose are preferred plants; they make up 55 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear under continuous heavy grazing and are replaced by desirable plants, such as sideoats grama, dropseeds, Scribner panicum, blue grama, buffalograss, silver bluestem, hairy grama, tall grama, scurfpea, lespedeza, heath aster, goldenrod, gayfeather, hackberry, elm, and sumac.

Continued overgrazing and extreme climatic conditions can cause a decline in the desirable plants. If this occurs, undesirable plants, such as hairy tridens, splitbeard bluestem, threeawn, annual bromes, common broomweed, croton, ragweeds, persimmon, and hawthorn, gradually dominate the site. As undesirable plants increase, the potential forage production is reduced.

Sandy Bottomland range site. The Yahola soil in map unit 65 is in this range site. The potential plant community species composition, by weight, is 93 percent grasses, 3 percent forbs, and 4 percent woody plants.

Switchgrass, indiangrass, big bluestem, eastern gamagrass, Illinois bundleflower, wholeleaf rosinweed, perennial sunflower, sand plum, and poison-ivy are preferred plants; they make up 60 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear under continuous heavy grazing and are replaced by desirable plants, such as little bluestem, dropseeds, Scribner panicum, purpletop, heath aster, goldenrod, elm, sumac, willow, and cottonwood.

Continued overgrazing and extreme climatic conditions can cause a decline in the desirable plants. If this occurs, undesirable plants, such as threeawns, broomsedge bluestem, lovegrasses, seacoast sumpweed, ragweeds, ironweeds, white snakeroot, and persimmon, gradually dominate the site. As undesirable plants increase, the potential forage production is reduced.

Sandy Savannah range site. The Bastrop, Chigley, Gasil, Gasil Variant, Konawa, Konsil, Naru, Stephenville Variant, and Bromide soils in map units 1, 2, 3, 8, 9, 10, 31, 33, 34, 40, 41, 53, 54, and 58 are in this range site. The potential plant community is a tall and mid grass aspect. Species composition, by weight, is 87 percent grasses, 3 percent forbs, and 10 percent woody plants.

Big bluestem, little bluestem, indiangrass, switchgrass, wildryes, tickclover, perennial lespedeza, ashy sunflower, poison-ivy, and grape are preferred plants; they make up 65 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear under continuous heavy grazing and are replaced by desirable plants, such as purpletop, sideoats grama, purple lovegrass, fringeleaf paspalum, tall dropseed, fall witchgrass, flatsedge, heath aster, prairie sagewort, goldenrod, post oak, blackjack oak, elm, sumac, blackberry, and hickory.

Continued overgrazing and extreme climatic conditions can cause a decline in the desirable plants (fig. 9). If this occurs, undesirable plants, such as silver bluestem, broomsedge bluestem, splitbeard bluestem, dropseeds, lovegrasses, threeawns, annual broomweed, western ragweed, bitter sneezeweed, camphorweed, hawthorn, and mesquite, gradually dominate the site. As undesirable plants increase, the potential forage production is reduced.

Shallow Prairie range site. The Grainola and Rayford soils in map units 35 and 46 are in this range site. The potential plant community is a mid and tall grass aspect. Species composition, by weight, is 92 percent grasses, 5 percent forbs, and 3 percent woody plants.

Little bluestem, indiangrass, big bluestem, switchgrass, sensitivebrier, prairie scurfpea, blacksamson, perennial sunflower, and skunkbush are preferred plants; they

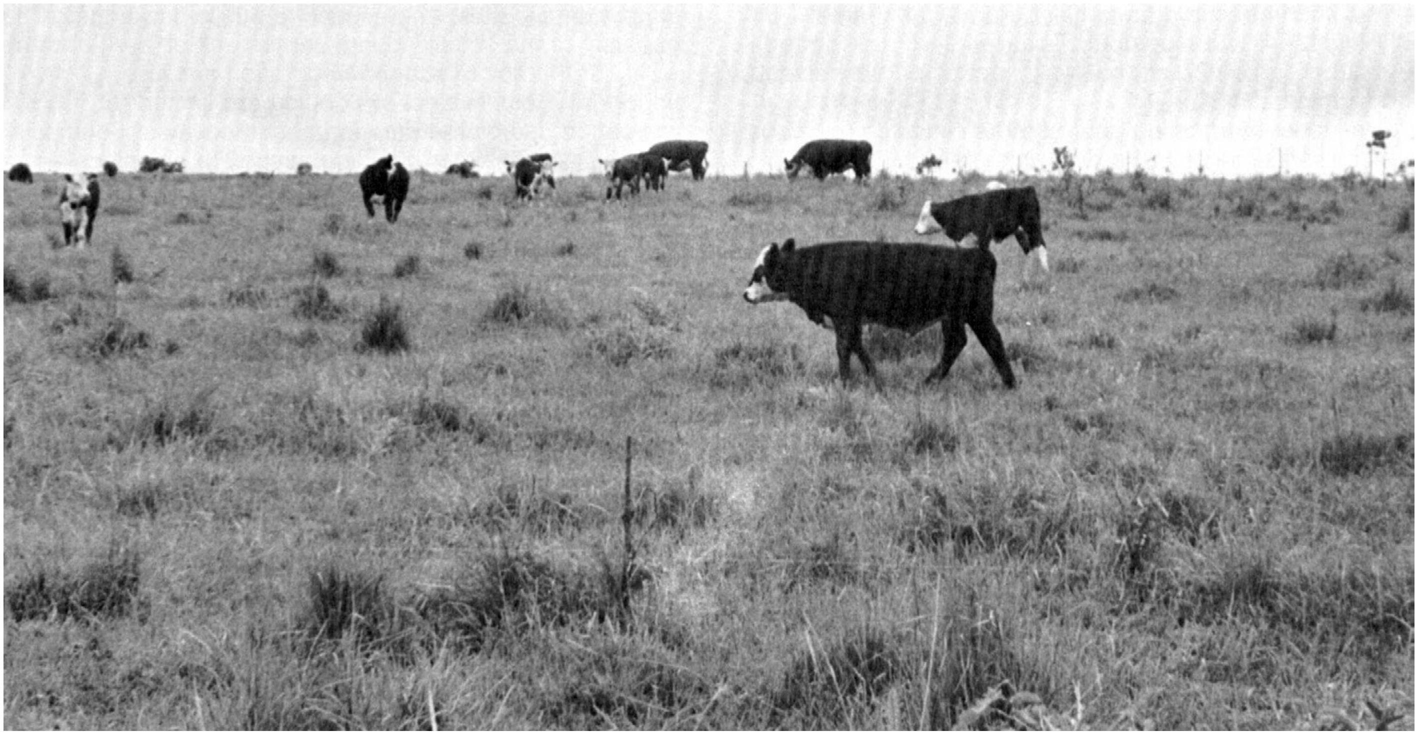


Figure 9.—Proper grazing and brush control keep the soils in this Sandy Savannah range site in good forage condition.

make up 65 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear under continuous heavy grazing and are replaced by desirable plants, such as sideoats grama, hairy grama, tall grama, dropseeds, Scribner panicum, wildindigo, heath aster, goldenrod, coralberry, and sumac.

Continued overgrazing and extreme climatic conditions can cause a decline in the desirable plants. If this occurs, undesirable plants, such as silver bluestem, windmillgrass, tumblegrass, broomsedge bluestem, annual bromes, threeawns, annual broomweed, ragweeds, bitter sneezeweed, persimmon, mesquite, juniper, and pricklypear cactus, gradually dominate the site. As undesirable plants increase, the potential forage production is reduced.

Shallow Savannah range site. The Darnell Variant and Travertine soils in map units 54 and 58 are in this range site. The potential plant community species composition, by weight, is 88 percent grasses, 4 percent forbs, and 8 percent woody plants.

Big bluestem, indiangrass, little bluestem, switchgrass, Canada wildrye, perennial lespedeza, prairie-clover, Virginia tephrosia, perennial sunflower, Pitcher sage, and gayfeather are preferred plants; they make up 65 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear under continuous heavy grazing and are replaced by desirable plants, such as sideoats grama, hairy grama, dropseeds, purpletop, fringeleaf paspalum, heath aster, prairie sagewort, post oak, blackjack oak, sumac, elms, and coralberry.

Continued overgrazing and extreme climatic conditions can cause a decline in the desirable plants. If this occurs, undesirable plants, such as silver bluestem, splitbeard bluestem, lovegrasses, western ragweed, bitter sneezeweed, and numerous annual weedy grasses and forbs, gradually dominate the site. As undesirable plants increase, the potential forage production is reduced.

Very Shallow range site. The Shidler soil in map units 7, 51, and 52 is in this range site. The potential plant community species composition, by weight, is 94 percent grasses, 5 percent forbs, and 1 percent woody plants.

Sideoats grama, rough tridens, trailing ratany, prairie-clover, blacksamson, and prairie rose and little bluestem, big bluestem, indiangrass, and switchgrass in crevices are preferred plants; they make up 50 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear under continuous heavy grazing and are replaced by desirable plants, such as blue grama, hairy grama, tall grama, buffalograss, silver bluestem, Texas wintergrass, dotted gayfeather, greenthread, nailwort, hackberry, elm, sumac, and skunkbush.

Continued overgrazing and extreme climatic conditions can cause a decline in the desirable plants. If this occurs, undesirable plants such as Texas grama, hairy tridens, ragweeds, pricklypear cactus, and numerous weedy grasses and forbs, such as bromes, threeawns, dropseed, broomweed, gaillardia, and plantain, gradually dominate the site. As undesirable plants increase, the potential forage production is reduced.

Windbreaks and Environmental Plantings

Norman E. Smola, forester, Soil Conservation Service, helped to prepare this section.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

Recreation

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer (fig. 10). Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm

Figure 10.—A public recreation area overlooking Turner Falls in an area of Rock outcrop-Kiti complex. 20 to 45 percent slopes. The steep slopes and shallow soil depth limit this complex for many recreational uses.

when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Billy M. Teels, biologist, Soil Conservation Service, helped to prepare this section.

Wildlife is relatively abundant throughout the county. Bobwhite quail, dove, rabbit, and coyote are in all areas of the county. Deer, squirrel, beaver, bobcat, raccoon, and wild turkey are common along bottom lands. Ducks and geese are common during fall and spring. Although the endangered whooping crane and southern bald eagle migrate through southern Oklahoma, only the southern bald eagle has been sighted in Murray County.

The Arbuckle Mountains in Murray County contain a number of unique or unusual animal groups and plant communities. Ashe juniper, short-lobe oak, Texas oak, and Texas ash occur in the Arbuckle Mountains and are rarely found in other areas of the state. The black-capped vireo, which is a proposed threatened species, occurs in the cedar brakes and hillsides in this region. The Washita River and clear, rocky streams in Murray County contain a number of relict fish populations, such as the rosy face shiner, freckled madtom, and redfin shiner.

The primary stream in Murray County, the Washita River, has long been one of the best catfish streams in the state. Channel, blue, and flathead catfish are taken from the Washita in all seasons by various methods. Late spring bark lining and trotlining produce the highest yields. The Washita River also contains large spring runs of white bass, which originate from Lake Texoma. The many farm ponds, floodwater retarding structures, and the Arbuckle Reservoir provide excellent fishing for largemouth bass and sunfish.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are roughleaf dogwood, skunkbush sumac, coralberry, and elderberry.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, rushes, and sedges.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include deer, horned lark, meadowlark, and jack rabbit.

Engineering

Charles E. Bollinger, assistant state conservation engineer, and Jesse L. McMasters, area civil engineer, Soil Conservation Service, helped to prepare this section.

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil (fig. 11). The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

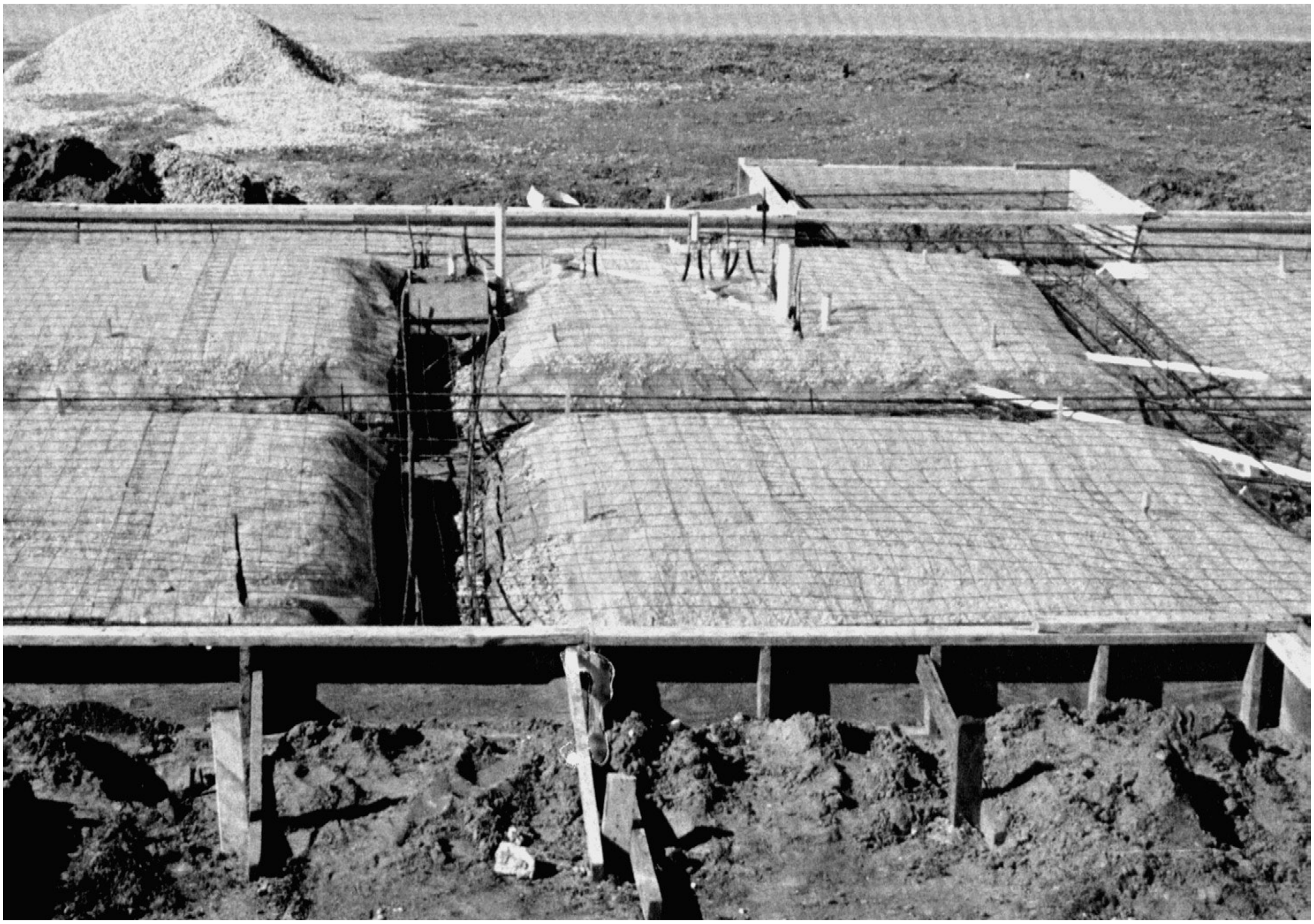


Figure 11.—A monolithic-type foundation can be used on Durant loam, which has high shrink-swell potential, to prevent cracking.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 12 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 20.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 15.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in sloughs and potholes.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs, on the average, no more than once in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; March-October, for example, means that flooding can occur during the period March through October.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An *artesian* water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Physical and Chemical Analyses of Selected Soils

The results of physical analysis of several typical pedons in the survey area are given in table 18 and the results of chemical analysis in table 19. The data are for soils sampled at carefully selected sites. The pedons are typical of the series and are described in the section "Soil Series and Their Morphology." Soil samples were analyzed by Oklahoma State University.

Most determinations, except those for grain-size analysis and bulk density, were made on soil material smaller than 2 millimeters in diameter. Measurements reported as percent or quantity of unit weight were calculated on an ovendry basis. The methods used in obtaining the data are indicated in the list that follows. The codes in parentheses refer to published methods (*5*).

Sand—(0.05-2.0 mm fraction) weight percentages of materials less than 2 mm (3A1).

Silt—(0.002-0.05 mm fraction) pipette extraction, weight percentages of all materials less than 2 mm (3A1).

Clay—(fraction less than 0.002 mm) pipette extraction, weight percentages of materials less than 2 mm (3A1).

Organic matter—peroxide digestion (6A3).

Base saturation—sum of cations, TEA, pH 8.2 (5C3).

Reaction (pH)—1:1 water dilution (8C1a).

Cation exchange capacity—sum of cations (5A3a).

Extractable cations—ammonium acetate, pH 7.0, uncorrected; calcium (6N2), magnesium (6O2), sodium (6P2), potassium (6Q2).

Total phosphorus—perchloric acid; colorimetry (6S1a).

Engineering Index Test Data

Table 20 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are typical of the series and are described in the section "Soil Series and Their Morphology." The soil samples were tested by the Oklahoma Department of Transportation Materials Division.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are: AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); Shrinkage—T 92 (AASHTO), D 427 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*6*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 21 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Fluvent (*Fluv*, meaning water deposit, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Ustifluvent (*Usti*, meaning ustic moisture regime, plus *fluvent*, the suborder of the Entisols that are deposits on flood plains).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Ustifluvents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is coarse-loamy, mixed (calcareous), thermic Typic Ustifluvents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*4*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*6*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Bastrop Series

The Bastrop series consists of deep, well drained, moderately permeable soils that formed in thick beds of loamy sediment. These very gently sloping to sloping soils are on high stream terraces. Slopes range from 1 to 8 percent. The soils of the Bastrop series are fine-loamy, mixed, thermic Udic Paleustalfs.

Bastrop soils are associated with Konawa and Teller soils, which are on lower terraces of streams. The Konawa soils have an argillic horizon that decreases in clay content in the lower part by 20 percent or more. Teller soils have a mollic epipedon.

Typical pedon of Bastrop fine sandy loam, 1 to 3 percent slopes; 1,600 feet east and 800 feet north of the southwest corner of sec. 7, T. 2 N., R. 2 E. (fig. 12):

Ap—0 to 8 inches; brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) moist; weak fine granular structure; slightly hard, friable; many fine roots; neutral; abrupt smooth boundary.

B21t—8 to 37 inches; yellowish red (5YR 5/8) clay loam, yellowish red (5YR 4/8) moist; moderate medium blocky structure; slightly hard, friable; many fine roots; clay films on faces of peds; neutral; gradual smooth boundary.

B22t—37 to 70 inches; red (2.5YR 5/8) clay loam, red (2.5YR 4/8) moist; weak medium blocky structure; hard, firm; clay films on faces of peds; neutral.

The solum is more than 60 inches thick. The soil is slightly acid or neutral throughout.

The A horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 3 or 4. It is fine sandy loam or loam. The B2t horizon has hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 6 to 8. It is sandy clay loam or clay loam.

Bromide Series

The Bromide series consists of moderately deep, well drained, moderately permeable soils that formed in loamy material weathered from tilted, platy, siliceous shale and siltstone. These sloping to steep soils are on side slopes of hills or ridges in the Arbuckle Mountains. Slopes are dominantly 5 to 25 percent. The soils of the Bromide series are loamy-skeletal, siliceous, thermic Ultic Haplustalfs.

The Bromide soils are associated with Chigley, Gasil Variant, Naru, and Travertine soils. Chigley soils are on ridgetops and side slopes and have a fine control section. Gasil Variant soils are on foot slopes and have a solum that is more than 60 inches thick. Naru soils are on low hills and ridges, are slowly permeable, and have limestone conglomerate at a depth of 55 to 65 inches. Travertine soils are on shoulders and summits of hills or ridges and have a solum that is less than 20 inches thick.

Typical pedon of Bromide channery silt loam, in an area of Travertine-Bromide complex, 5 to 25 percent slopes; 1,400 feet west and 750 feet north of the southeast corner of sec. 1, T. 2 S., R. 2 E.

A1—0 to 4 inches; brown (10YR 5/3) channery silt loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, friable; common medium and coarse roots; many fine and medium pores; about 30 percent, by volume, flat fragments of shale and siltstone; slightly acid; gradual smooth boundary.

A2—4 to 18 inches; light brown (7.5YR 6/4) channery silt loam, brown (7.5YR 5/4) moist; weak fine

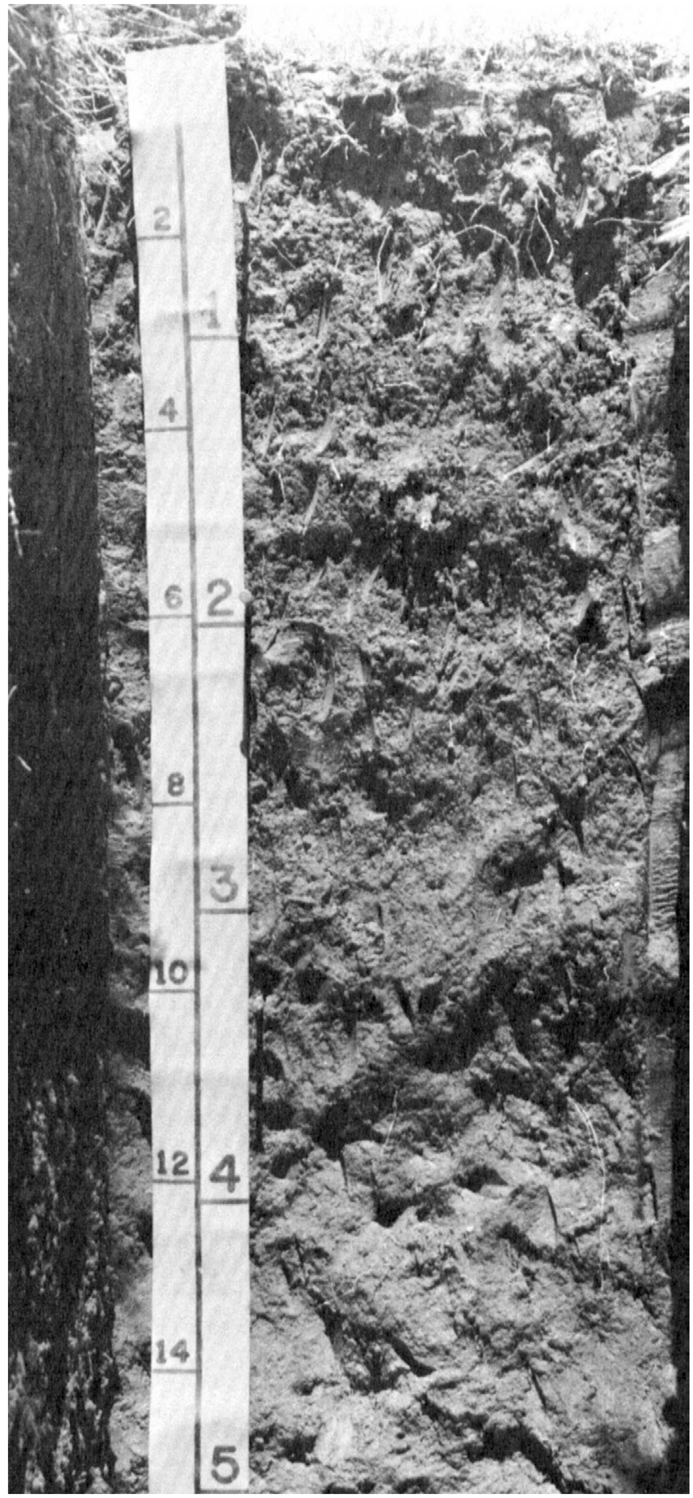


Figure 12.—A profile of Bastrop fine sandy loam showing the surface layer in the upper 7 inches and the reddish clay loam subsoil. (The scale on the right is in feet. Multiply the scale on the left by 10 to obtain the depth in centimeters.)

granular structure; soft, friable; common medium and coarse roots; many fine and medium pores; about 30 percent, by volume, flat fragments of shale and siltstone; medium acid; clear wavy boundary.

B2t—18 to 32 inches; light brown (7.5YR 6/4) extremely channery silty clay loam, brown (7.5YR 5/4) moist; many medium distinct yellowish red (5YR 5/6) and pale brown (10YR 6/3) mottles; weak medium blocky structure; hard, firm; few fine and medium roots; patchy clay films on faces of peds; about 70 percent, by volume, flat fragments of shale and siltstone; strongly acid; gradual smooth boundary.

B3—32 to 36 inches; pink (7.5YR 7/4) extremely channery silt loam, brown (7.5YR 5/4) moist; weak fine granular structure; soft, friable; about 80 percent, by volume, flat fragments of shale and siltstone; slightly acid; clear wavy boundary.

Cr—36 to 40 inches; platy siliceous shale and siltstone tilted 60 degrees from horizontal.

The solum is 20 to 40 inches thick. Depth to shale and siltstone bedrock ranges from 20 to 44 inches.

The A1 horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 or 3. The A2 horizon has hue of 7.5YR or 10YR, value of 4 to 7, and chroma of 3 to 5. The A horizon is channery silt loam or channery loam. Coarse, flat fragments make up 15 to 35 percent by volume. About 5 to 15 percent is less than 76 millimeters across, and 10 to 20 percent is more than 76 millimeters across. The A horizon is strongly acid to slightly acid.

The B2t horizon has hue of 5YR or 7.5YR, value of 4 to 7, and chroma of 4 to 6. It has mottles in shades of red or brown. The B2t horizon is extremely channery silty clay loam or extremely channery silt loam. Coarse, flat fragments make up 60 to 85 percent by volume. About 20 to 25 percent is less than 76 millimeters across, and 40 to 60 percent by volume is more than 76 millimeters across. Base saturation is less than 75 percent, by sum of cations, through the B2t horizon. The horizon is strongly acid to slightly acid.

The B3 horizon has hue of 5YR or 7.5YR, value of 6 to 8, and chroma of 4 to 6. It is extremely channery silt loam or extremely channery loam. Coarse, flat fragments make up 75 to 90 percent by volume. About 20 to 25 percent is less than 76 millimeters across, and 55 to 65 percent is more than 76 millimeters across. The B3 horizon is strongly acid to slightly acid.

The Cr horizon is platy, siliceous shale and siltstone that is tilted more than 20 degrees from horizontal.

Burleson Series

The Burleson series consists of deep, moderately well drained soils that formed in clayey sediment. Permeability is very slow. These very gently sloping soils are on high stream terraces. Slopes are dominantly 2 percent but range from 1 to 3 percent. The soils of the Burleson series are fine, montmorillonitic, thermic Udic Pellusterts.

Burleson soils are associated with Clarita and Durant soils. Clarita soils are on low ridges and upper side slopes and have an AC horizon that has hue of 10YR or redder. Durant soils are on foot slopes and broad flats and have an argillic horizon.

Typical pedon of Burleson clay, 1 to 3 percent slopes; 1,220 feet west and 70 feet south of the northeast corner of sec. 5, T. 1 S., R. 3 E.

Ap—0 to 5 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak fine blocky structure; hard, firm; few medium roots; neutral; clear smooth boundary.

A1—5 to 29 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; weak medium blocky structure; extremely hard, extremely firm; pronounced intersecting slickensides in the lower part; few medium roots; few old cracks filled with dark gray clay from the Ap horizon; few black concretions that range from 1 millimeter to 2 millimeters; mildly alkaline; clear wavy boundary.

AC1—29 to 50 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; few medium distinct light olive gray (5Y 6/2) mottles; distinct intersecting slickensides and parallelepipeds that are tilted 35 degrees from horizontal, parting to weak coarse blocky structure; extremely hard, extremely firm; many old cracks filled with very dark gray clay; shiny pressure faces on peds; few black concretions ranging from 1 millimeter to 3 millimeters; common soft bodies of calcium carbonate ranging from 1 millimeter to 5 millimeters; moderately alkaline; clear wavy boundary.

AC2—50 to 72 inches; coarsely mottled dark grayish brown (10YR 4/2), light olive gray (5Y 6/2), pale brown (10YR 6/3), and pale olive (5Y 6/4) clay; few distinct slickensides and parallelepipeds; extremely hard, extremely firm; few black concretions; few soft bodies of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum ranges from 40 to 80 inches.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 1. It is neutral or mildly alkaline. Intersecting slickensides are in the lower part of the A horizon. Where present, vertical cracks are filled with material from the Ap horizon.

The AC horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 3. Few to common, faint or distinct, grayish, brownish, or olive mottles are in the upper part; the horizon becomes more distinctly mottled as depth increases. The AC horizon is clay. It is mildly alkaline or moderately alkaline and noncalcareous or calcareous. Intersecting slickensides and parallelepipeds are present.

Catoosa Series

The Catoosa series consists of moderately deep, well drained, moderately permeable soils that formed in loamy material weathered from limestone. These very gently sloping to sloping soils are on uplands in the northeastern part of the county. Slopes are dominantly 3 to 5 percent but range from 2 to 8 percent. The soils of the Catoosa series are fine-silty, mixed, thermic Typic Argiudolls.

The Catoosa soils in this survey area are taxadjuncts to the Catoosa series. They are slightly more alkaline throughout and are slightly dryer than is typical for the Catoosa series. This difference, however, does not significantly affect use, behavior, and management.

Catoosa soils are associated with the Claremore, Lula, and Shidler soils. Claremore soils are on ridgetops and upper side slopes and are less than 20 inches thick over limestone bedrock. Lula soils are on lower slopes and are 40 to 60 inches thick over limestone bedrock. Shidler soils are on very gently sloping to sloping ridges and are less than 20 inches thick over hard, fractured limestone bedrock.

Typical pedon of Catoosa silt loam, in an area of Catoosa-Shidler complex, 2 to 8 percent slopes; 1,100 feet south and 1,550 feet east of the northwest corner of sec. 32, T. 1 N., R. 4 E.

A1—0 to 10 inches; reddish brown (5YR 4/3) silt loam, dark reddish brown (5YR 3/3) moist; moderate fine granular structure; many fine and medium roots; slightly hard, friable; neutral; gradual smooth boundary.

B1—10 to 18 inches; reddish brown (5YR 4/3) silty clay loam, dark reddish brown (5YR 3/3) moist; moderate medium granular structure; hard, friable; common fine and medium roots; mildly alkaline; gradual smooth boundary.

B2t—18 to 29 inches; red (2.5YR 4/6) silty clay loam, dark red (2.5YR 3/6) moist; moderate medium subangular blocky structure; hard, firm; few fine roots; clay films on faces of peds; moderately alkaline; abrupt smooth boundary.

R—29 to 31 inches; hard, flat-bedded limestone bedrock.

Thickness of the solum ranges from 20 to 40 inches.

The A horizon has hue of 5YR, value of 4, and chroma of 2 or 3. It is slightly acid or neutral.

The B1 horizon has hue of 5YR, value of 3 or 4, and chroma of 2 to 4. It is silt loam or silty clay loam. The B1 horizon is neutral or mildly alkaline. The B2t horizon has hue of 2.5YR or 5YR, value of 3 or 4, and chroma of 4 to 6. It is silty clay loam. It commonly becomes more clayey in the lower part. The B2t horizon is mildly alkaline or moderately alkaline.

The R layer is hard, fractured, flat-bedded limestone bedrock. It ranges from 2 feet to several feet in thickness.

Chigley Series

The Chigley series consists of deep, moderately well drained soils that formed in mostly clayey material weathered from conglomerate rock (fig. 13). Permeability is moderately slow. These very gently sloping to steep soils are on ridgetops and side slopes of uplands. Slopes range from 1 to 30 percent. The soils of the Chigley series are fine, mixed, thermic Udic Paleustalfs.

Chigley soils are associated with the Bromide, Clarita, Durant, Gasil Variant, Naru, Travertine, and Tussy soils. Bromide soils are on side slopes and have a loamy-skeletal control section. Clarita soils are on the lower ridges and side slopes, have montmorillonitic mineralogy and intersecting slickensides, and are cyclic. Durant soils are on side slopes and broad flats and have a mollic epipedon, montmorillonitic mineralogy, and cracks 1 centimeter or more in width that extend from the surface to a depth of 20 inches. Gasil Variant soils are on foot slopes and have a loamy-skeletal control section. Naru soils are on side slopes and have a loamy-skeletal control section. Travertine soils are on shoulders and summits of hills and ridges and have a loamy-skeletal control section. Tussy soils are on convex summits and side slopes; they developed from calcareous shales and have a fine control section and montmorillonitic mineralogy.

Typical pedon of Chigley gravelly sandy loam, 1 to 5 percent slopes; 3,150 feet south and 75 feet east of the northwest corner of sec. 28, T. 2 N., R. 3 E.

A1—0 to 4 inches; brown (10YR 4/3) gravelly sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, very friable; about 20 percent, by volume, chert fragments less than 76 millimeters across; few roots; neutral; clear wavy boundary.

A2—4 to 6 inches; brown (7.5YR 5/4) gravelly sandy loam, dark brown (7.5YR 4/4) moist; weak fine granular structure; slightly hard, very friable; about 20 percent, by volume, chert fragments less than 76 millimeters across; few roots; neutral; clear wavy boundary.

B21t—6 to 18 inches; yellowish red (5YR 5/6) gravelly clay, yellowish red (5YR 4/6) moist; moderate medium blocky structure; very hard, very firm; clay films on faces of peds; about 15 percent by volume, chert fragments less than 76 millimeters across; medium acid; gradual smooth boundary.

B22t—18 to 26 inches; red (2.5YR 5/8) gravelly clay, red (2.5YR 4/8) moist; common medium distinct yellowish brown (10YR 5/4) mottles; moderate coarse blocky structure; very hard, very firm; clay

Figure 13.—A profile of Chigley gravelly sandy loam showing small gravel and root distribution throughout. (The scale is in feet.)

films on faces of peds; few nonintersecting slickensides; about 15 percent, by volume, chert fragments less than 76 millimeters across; medium acid; gradual smooth boundary.

B23t—26 to 38 inches; light yellowish brown (10YR 6/4) gravelly clay, yellowish brown (10YR 5/4) moist; few medium prominent red (2.5YR 4/8) mottles and few coarse and medium faint pale brown (10YR 6/3) mottles; weak coarse blocky structure; extremely hard, extremely firm; thin clay films on faces of peds; about 25 percent, by volume, chert fragments less than 76 millimeters across; medium acid; gradual smooth boundary.

B3—38 to 54 inches; reddish yellow (7.5YR 6/6) clay, strong brown (7.5YR 5/6) moist; many fine and medium faint pale brown (10YR 6/3) mottles; weak coarse blocky structure; very hard, very firm; about 10 percent, by volume, chert fragments less than 76 millimeters across; slightly acid; gradual smooth boundary.

C—54 to 64 inches; yellowish brown (10YR 5/4) gravelly clay, dark yellowish brown (10YR 4/4) moist; few medium prominent red (2.5YR 4/6) mottles; massive; very hard, very firm; about 20 percent, by volume, chert fragments less than 76 millimeters across; neutral.

Thickness of the solum ranges from 40 to 60 inches.

The A1 or Ap horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 4. It is medium acid to neutral. The A2 horizon has hue of 7.5YR or 10YR, value of 4 to 7, and chroma of 2 to 4. It is strongly acid to neutral. About 15 to 30 percent of the A horizon is coarse fragments less than 76 millimeters across.

The upper part of the B horizon has hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 4 to 8. Hue in the lower part of the B horizon ranges to 10YR. The B horizon is clay, gravelly clay, gravelly sandy clay, or sandy clay. In some pedons, the B horizon has mottles in shades of brown, yellow, red, and gray. The upper part of the B horizon is strongly acid to neutral, and the lower part is slightly acid to moderately alkaline. About 5 to 35 percent of the B horizon is coarse fragments less than 76 millimeters across.

The C horizon has colors similar to those of the B horizon. The C horizon is gravelly or very gravelly clay, gravelly or very gravelly sandy clay, gravelly or very gravelly clay loam, or gravelly or very gravelly sandy clay loam. About 20 to 50 percent is coarse fragments less than 76 millimeters across. The C horizon is neutral to moderately alkaline.

Some pedons have an R layer that is a hard conglomerate of sandstone, quartz, or limestone rock fragments.

Soils that have a gravelly loam surface layer; a mollic epipedon more than 20 inches thick; and a loam, sandy clay, or clay loam subsoil are included with the Chigley soils as part of the taxonomic unit. Their behavior is very similar to that of the Chigley soils.

Claremore Series

The Claremore series consists of shallow, well drained, moderately permeable soils that formed in loamy material weathered from limestone. These very gently sloping to gently sloping soils are on broad ridgetops of uplands. Slopes range from 1 to 5 percent. The soils of the Claremore series are loamy, mixed, thermic Lithic Argiudolls.

The Claremore soils in this survey area are taxadjuncts to the Claremore series. They are slightly more alkaline in the B2t horizon and are slightly drier than is typical for the Claremore series. This difference, however, does not significantly affect use, behavior, or management of the soils.

Claremore soils are associated with Catoosa, Clarita, Fitzhugh, Lula, and Shidler soils. Catoosa soils are on convex ridges and upper side slopes and have a solum that is 20 to 40 inches thick over hard limestone. Clarita soils are on lower slopes and have a fine control section. Fitzhugh soils are on lower slopes and are fine-loamy. Lula soils are on lower slopes and have a solum that is 40 to 60 inches thick over hard limestone. Shidler soils are on landscape positions similar to the Claremore soils, but the Shidler soils do not have an argillic horizon.

Typical pedon of Claremore loam, in an area of Claremore-Rock outcrop complex, 1 to 5 percent slopes; 250 feet east and 2,400 feet south of the northwest corner of sec. 9, T. 1 S., R. 4 E.

A1—0 to 10 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable; many fine and medium roots; neutral; clear smooth boundary.

B2t—10 to 18 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, firm; common fine roots; thick continuous clay films on faces of peds; moderately alkaline; abrupt wavy boundary.

R—18 to 20 inches; hard limestone bedrock that has occasional fractures three feet or more apart.

Thickness of the solum and depth to limestone bedrock range from 12 to 20 inches.

The A horizon has hue of 7.5YR or 10YR, value of 3 or 4 and chroma of 2 to 3. Some pedons have a B1 horizon that has hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 to 4. It is loam, and reaction is neutral.

The B2t horizon has hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam or silty clay loam. The B2t horizon is neutral to moderately alkaline.

The R layer is hard limestone bedrock that is fractured at intervals of 3 feet or more. The upper part of these fractures is filled with soil material similar to the soil of the B2t horizon.

Clarita Series

The Clarita series consists of deep, moderately well drained soils that formed in clays. Permeability is very slow. These very gently sloping to strongly sloping soils are on broad ridgetops and side slopes. Slopes range from 2 to 12 percent. The soils of the Clarita series are fine, montmorillonitic, thermic Udic Pellusterts.

The Clarita soils in this survey area are taxadjuncts to the Clarita series. They have a brownish A horizon in more than 50 percent of the pedons. They are similar enough to Clarita soils in their behavior, use, and management, however, that it is not necessary to place them in a separate series.

Clarita soils are associated with the Burleson, Claremore, Chigley, Durant, Fitzhugh, Shidler, Tussy, and Wilson soils. Burleson soils are on broad flats and have an AC horizon that has hue of 10YR. Claremore and Shidler soils are on broad ridges and are shallow over limestone. Chigley soils are on convex ridges and side slopes; they have mixed mineralogy, do not have intersecting slickensides, and are not cyclic. Durant soils have a mollic epipedon and an argillic horizon; they are on lower slopes and broad flats. Fitzhugh soils are on low ridgetops and foot slopes and are fine-loamy. Tussy soils are on convex summits and side slopes, and Wilson soils are on high stream terraces. These two soils have a fine control section but do not have intersecting slickensides.

Typical pedon of Clarita clay, 2 to 5 percent slopes, eroded; 2,600 feet east and 2,000 feet south of the northwest corner of sec. 16, T. 1 N., R. 2 E.

A1—0 to 8 inches; brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; weak medium subangular blocky structure; hard, firm; many fine roots; mildly alkaline; clear wavy boundary.

AC1—8 to 18 inches; brown (7.5YR 4/4) clay, dark brown (7.5YR 3/4) moist; weak medium blocky structure; very hard, very firm; common fine roots; intersecting slickensides; vertical cracks 1/2-inch wide filled with brown (7.5YR 4/2) clay; moderately alkaline; gradual wavy boundary.

AC2—18 to 35 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; weak coarse blocky structure; very hard, very firm; few fine roots; intersecting slickensides; vertical cracks 1/2-inch wide filled with brown (7.5YR 4/2) clay; moderately alkaline; gradual wavy boundary.

C—35 to 65 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; common fine and medium faint reddish yellow (5YR 6/6) mottles and few fine distinct gray (10YR 5/1) and light yellowish brown (10YR 6/4) mottles; massive; very hard, very firm; common soft bodies of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum ranges from 35 to more than 60 inches. Thickness of the A horizon is least in the microknolls and greatest in the microdepressions.

The A horizon has hue of 5YR to 10YR, value of 3 to 5, and chroma of 1 or 2. It is clay or silty clay. The A horizon is slightly acid to moderately alkaline. The AC horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is clay or silty clay. Intersecting slickensides are present.

The C horizon has hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 3 to 8. It is mottled in shades of brown, gray, red or yellow. The C horizon is clay or silty clay. Some pedons contain soft, powdery lime and small limestone fragments.

Dale Series

The Dale series consists of deep, well drained, moderately permeable soils that formed in loamy alluvium. These nearly level soils are on flood plains of the Washita River and its larger tributaries. Slopes are 0 to 1 percent. The soils of the Dale series are fine-silty, mixed, thermic Pachic Haplustolls.

Dale soils are associated with McLain and Watonga soils. McLain and Watonga soils are on landscape positions similar to those of Dale soils, but they are closer to the uplands. McLain and Watonga soils have a fine control section.

Typical pedon of Dale silt loam, rarely flooded; 2,540 feet west and 300 feet north of the southeast corner of sec. 1, T. 1 N., R. 1 E.

A—0 to 22 inches; dark reddish gray (5YR 4/2) silt loam, dark reddish brown (5YR 3/2) moist; moderate medium granular structure; hard, friable; many fine roots; neutral; clear smooth boundary.

B2—22 to 46 inches; yellowish red (5YR 5/6) silt loam, yellowish red (5YR 4/6) moist; moderate fine subangular blocky structure parting to moderate medium granular; hard, friable; many fine roots; moderately alkaline; gradual smooth boundary.

C—46 to 75 inches; red (2.5YR 5/8) silt loam, red (2.5YR 4/8) moist; massive; hard, friable; few fine roots; few films of calcium carbonate; calcareous; moderately alkaline.

Depth to soft, powdery secondary lime ranges from 20 to 60 inches. Thickness of the mollic epipedon ranges from 20 to 36 inches. Depth to a water table is more than 75 inches.

The A horizon has hue of 5YR to 10YR, value of 3 or 4, and chroma of 2 or 3. It is neutral or mildly alkaline. The B horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 to 8. It is silt loam or silty clay loam. The B horizon is mildly alkaline or moderately alkaline. The C horizon has hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 3 to 8. It is silt loam, loam, or silty clay loam.

Darnell Variant

The Darnell Variant consists of shallow, well drained soils that formed in loamy material weathered from tilted sandstone. Permeability is moderately rapid. These gently sloping to moderately steep soils are on ridgetops. Slopes are 5 to 20 percent. The soils of the Darnell Variant are loamy, siliceous, thermic Lithic Ustochrepts.

Darnell Variant soils are associated with Stephenville Variant soils. Stephenville Variant soils are on lower side slopes and have a solum that is 20 to 40 inches thick over sandstone.

Typical pedon of Darnell Variant fine sandy loam, in an area of Stephenville Variant-Darnell Variant complex, 5 to 20 percent slopes; 1,600 feet south and 900 feet west of the northeast corner of sec. 9, T. 1 S., R. 4 E.

A1—0 to 6 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; slightly acid; gradual smooth boundary.

B2—6 to 14 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; slightly acid; abrupt irregular boundary.

R—14 to 20 inches; brown (7.5YR 5/4) indurated sandstone; tilted 30 degrees from horizontal.

Thickness of the solum and depth to bedrock range from 10 to 20 inches.

The A1 horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 4. It is strongly acid to slightly acid. The B2 horizon has hue of 5YR to 10YR, value of 4 to 7, and chroma of 3 to 6. It is strongly acid to slightly acid. The R layer is reddish or brownish indurated sandstone that is tilted more than 20 degrees from horizontal.

Durant Series

The Durant series consists of deep, moderately well drained soils that formed in clayey material. Permeability is very slow. These nearly level to gently sloping soils are on uplands, mainly in the northern part of the county. Slopes are dominantly 0 to 3 percent but range to 5 percent. The soils of the Durant series are fine, montmorillonitic, thermic Vertic Argiustolls.

Durant soils are associated with Burleson, Chigley, Clarita, Grainola, Renfrow, and Wilson soils. Burleson soils are on broad flats, and Clarita soils are on ridgetops and side slopes; these soils do not have an argillic horizon. Chigley soils are on ridgetops and side slopes; they have a sandier surface layer and do not have wide cracks during dry periods. Grainola and Renfrow soils are on side slopes; these soils formed over red shale and have a reddish argillic horizon. Wilson soils are on broad, nearly level flats, are somewhat poorly drained, and do not have a mollic epipedon.

Typical pedon of Durant loam, 1 to 3 percent slopes; 350 feet east and 600 feet south of the northwest corner of sec. 24, T. 2 S., R. 3 E.

A1—0 to 9 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; hard, friable; slightly acid; clear wavy boundary.

B1—9 to 15 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; common fine distinct yellowish red mottles; moderate medium subangular blocky structure; hard, firm; patchy clay films on faces of peds; neutral; gradual smooth boundary.

B21t—15 to 30 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium blocky structure; very hard, very firm; thick continuous clay films on faces of peds; mildly alkaline; gradual smooth boundary.

B22t—30 to 46 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate coarse blocky structure; very hard, very firm; thick continuous clay films on faces of peds; few calcium carbonate concretions in lower part; moderately alkaline; gradual smooth boundary.

B3—46 to 64 inches; brownish yellow (10YR 6/6) clay, yellowish brown (10YR 5/6) moist; common medium distinct strong brown (7.5YR 5/8) and gray (10YR 6/1) mottles; weak coarse blocky structure; very hard, very firm; thin patchy clay films on faces or peds; soft powdery lime in lower part; moderately alkaline.

Thickness of the solum ranges from 46 to more than 60 inches. Depth to calcium carbonate concretions or disseminated lime ranges from about 30 to 60 inches.

The A horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 or 3. It is medium acid or slightly acid.

The B1 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 to 4. It is clay loam or clay. The B1 horizon is slightly acid or neutral. The B2t horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 6. Some pedons have mottles in shades of red, brown, or yellow. The B2t horizon is neutral or mildly alkaline in the upper part and mildly alkaline or moderately alkaline in the lower part. The B3 horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 4 to 6. Mottles are in shades of yellow, brown, or gray. Some pedons have nonintersecting slickensides.

Elandco Series

The Elandco series consists of deep, well drained, moderately permeable soils that formed in loamy alluvial sediment. These nearly level soils are on flood plains. Slopes are mainly less than 1 percent and, in places, are concave. The soils of the Elandco series are fine-silty, mixed, thermic Cumulic Haplustolls.

Elandco soils are associated with Garvin soils. Garvin soils are in similar landscape positions, and they have a fine control section.

Typical pedon of Elandco silt loam, occasionally flooded; 400 feet west and 600 feet north of the southwest corner of sec. 6, T. 2 N., R. 2 E.

A11—0 to 21 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; hard, friable; many fine and medium roots; mildly alkaline; clear smooth boundary.

A12—21 to 28 inches; brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; hard, firm; common fine and medium roots; moderately alkaline; gradual smooth boundary.

A13—28 to 58 inches; brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; hard, firm; common fine roots; few films of calcium carbonate; moderately alkaline; gradual smooth boundary.

C—58 to 75 inches; yellowish brown (10YR 5/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; massive; hard, firm; few films of calcium carbonate; calcareous; moderately alkaline.

Depth to films of calcium carbonate ranges from 25 to 50 inches.

The A11 horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is slightly acid or mildly alkaline. The A12 and A13 horizons have hue of 10YR, value of 4 to 5, and chroma of 2 or 3. They are mildly alkaline or moderately alkaline.

The C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. Up to 10 percent gravel, by volume, is below a depth of 60 inches in some pedons.

Eufaula Series

The Eufaula series consists of deep, somewhat excessively drained, rapidly permeable soils that formed in sandy sediment. These undulating to hummocky soils are on terraces of uplands in the southeastern part of the county. Slopes range from 2 to 8 percent. The soils of the Eufaula series are sandy, siliceous, thermic Psammentic Paleustalfs.

Eufaula soils are associated with Konawa soils. Konawa soils are on lower parts of the landscape and have a loamy control section.

Typical pedon of Eufaula loamy fine sand, undulating; 5,000 feet east and 4,000 feet north of the southwest corner sec. 33, T. 1 S., R. 2 E.

Ap—0 to 4 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; single grained; loose; neutral; clear smooth boundary.

A1—4 to 10 inches; brown (10YR 5/3) loamy fine sand; brown (10YR 4/3) moist; single grained; loose; neutral; clear smooth boundary.

A21—10 to 36 inches; light yellowish brown (10YR 6/4) loamy fine sand; yellowish brown (10YR 5/4) moist; single grained; loose; neutral; clear wavy boundary.

A22&B2t—36 to 80 inches; pink (7.5YR 7/4) fine sand, light brown (7.5YR 5/4) moist (A22); single grained; loose; lamellae of yellowish red (5YR 5/6) loamy fine sand (B2t); the lamellae are massive; slightly hard, friable; lamellae are wavy and discontinuous, 1/8-inch thick and 4 inches apart; the lamellae have clay bridges between the sand grains; slightly acid.

The solum is more than 72 inches thick.

The Ap or A1 horizon has hue of 7.5YR or 10YR, value of 4 to 7, and chroma of 2 to 4. It is slightly acid or neutral. The A2 horizon has hue of 7.5YR or 10YR, value of 6 to 8, and chroma of 2 to 4. It is loamy fine sand or fine sand. The A2 horizon is slightly acid or neutral. The B2 horizon has hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 6 or 8. It is loamy fine sand or fine sandy loam.

Fitzhugh Series

The Fitzhugh series consists of deep, well drained, moderately permeable soils that formed in loamy material weathered from interbedded sandstone and sandy shale. These very gently sloping or gently sloping soils are on low ridgetops and foot slopes of uplands in the northeastern part of the county. Slopes range from 1 to 5 percent. The soils of the Fitzhugh series are fine-loamy, mixed, thermic Typic Argiudolls.

The Fitzhugh soils in this survey area are taxadjuncts to the Fitzhugh series. They are commonly slightly drier and more alkaline than is typical for the Fitzhugh series. This difference, however, does not significantly affect use, behavior or management.

Fitzhugh soils are associated with Catoosa, Claremore, Clarita, Lula, and Shidler soils. These soils are on higher parts of the landscape and, except for the Clarita soils, developed over limestone. Clarita soils have a fine control section.

Typical pedon of Fitzhugh loam, 1 to 3 percent slopes; 1,800 feet north and 2,100 feet east of the southwest corner of sec. 4, T. 1 N., R. 4 E.

A1—0 to 14 inches; brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; moderate fine granular structure; slightly hard, friable; neutral; gradual smooth boundary.

B1—14 to 18 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium and fine subangular blocky structure; hard, firm; clay films on faces of peds; neutral; gradual smooth boundary.

B21t—18 to 40 inches; reddish brown (2.5YR 5/4) clay loam, reddish brown (2.5YR 4/4) moist; moderate medium subangular blocky structure; very hard, firm; few black concretions; clay films on faces of peds; neutral; gradual smooth boundary.

B3—40 to 54 inches; red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; weak coarse subangular blocky structure; hard, firm; common fine and medium black concretions; few sandstone fragments less than 3 inches across; slightly acid; gradual smooth boundary.

Cr—54 to 60 inches; dark red (2.5YR 3/6) and light gray (10YR 7/1) alternating layers of sandstone and sandy shale.

Thickness of the solum and depth to sandstone bedrock range from 40 to 60 inches.

The A1 horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 or 3. It is medium acid to neutral.

The B1 horizon has colors similar to those of the A1 horizon. The B2t horizon and B3 horizon have hue of 2.5YR or 5YR, value of 4 or 5 and chroma of 3 to 8. The B1 and B21t horizons are loam or clay loam. The B3 horizon is sandy clay loam or clay loam, and it contains a few sandstone fragments that are less than 76 millimeters across. The B horizon ranges from medium acid to neutral.

The Cr horizon consists of alternating layers of reddish and grayish sandstone and sandy shale.

Garvin Series

The Garvin series consists of deep, moderately well drained soils that formed from clayey and silty sediments. Permeability is very slow. These nearly level soils are on flood plains of small streams. Slopes are less than 1 percent. The soils of the Garvin series are fine, mixed, thermic Vertic Haplustolls.

Garvin soils are associated with Elandco and Yahola soils on the same flood plain. Elandco soils have a fine-silty control section, and Yahola soils are coarse-loamy.

Typical pedon of Garvin silty clay, occasionally flooded; 2,900 feet west and 1,200 feet south of the northeast corner sec. 26, T. 1 N., R. 2 E.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; hard, firm; mildly alkaline; clear wavy boundary.

A1—6 to 22 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; moderate medium subangular blocky structure; hard, firm; calcareous; moderately alkaline; clear wavy boundary.

B2—22 to 42 inches; reddish brown (5YR 5/4) silty clay, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; very hard, very firm; few vertical cracks filled with dark grayish brown (10YR 4/2) silty clay; few pressure faces; common films of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C—42 to 80 inches; reddish brown (5YR 5/3) silty clay, reddish brown (5YR 4/3) moist; massive; very hard, very firm; about 10 percent, by volume, coarse fragments less than 76 millimeters across; common fine soft bodies of calcium carbonate; calcareous; moderately alkaline.

The solum is more than 40 inches thick.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 to 3. It is silty clay loam or silty clay. The A horizon is neutral to moderately alkaline.

The B2 horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is silty clay or silty clay loam. The B2 horizon is moderately alkaline.

The C horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 2 to 6. It is silty clay or silty clay loam. The C horizon is moderately alkaline. When dry, the soil has occasional cracks more than 1 centimeter in width to a depth of 20 inches.

Gasil Series

The Gasil series consists of deep, well drained, moderately permeable soils that formed in material weathered from weakly consolidated sandstone or packsand. These very gently sloping to gently sloping soils are on uplands, mainly in the southeastern part of the county. Slopes range from 1 to 5 percent but are dominantly 2 to 3 percent. The soils of the Gasil series are fine-loamy, siliceous, thermic Ultic Paleustalfs.

Gasil soils are associated with Konsil soils. Konsil soils are on side slopes and have an argillic horizon with hue of 5YR or redder.

Typical pedon of Gasil fine sandy loam, 1 to 3 percent slopes; 1,900 feet south and 2,100 feet west of the northeast corner of sec. 16, T. 1 S., R. 4 E.

A—0 to 16 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak fine granular structure; hard, friable; many fine roots; slightly acid; clear smooth boundary.

B21t—16 to 20 inches; light brown (7.5YR 6/4) sandy clay loam, dark brown (7.5YR 4/4) moist; weak fine subangular blocky structure; hard, firm; common fine roots; patchy clay films on faces of peds; strongly acid; gradual smooth boundary.

B22t—20 to 30 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; few fine distinct red mottles; moderate medium subangular blocky structure; hard, firm; clay films on faces of peds; strongly acid; gradual smooth boundary.

B23t—30 to 48 inches; reddish yellow (7.5YR 6/8) sandy clay loam, strong brown (7.5YR 5/8) moist; common medium distinct red (2.5YR 5/8) mottles; moderate medium subangular blocky structure; hard, firm; few black concretions; clay films on faces of peds; medium acid; gradual smooth boundary.

B24t—48 to 64 inches; reddish yellow (7.5YR 6/8) sandy clay loam, strong brown (7.5YR 5/8) moist; many coarse distinct white (10YR 8/1) and yellowish brown (10YR 5/6) mottles; weak medium prismatic structure; hard, firm; few black concretions; clay films on faces of peds; medium acid; gradual smooth boundary.

B25t—64 to 80 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; many coarse distinct white (10YR 8/1) and yellowish red (5YR 5/8) mottles; weak coarse prismatic structure; hard, firm; few black concretions; patchy clay films on faces of peds; slightly acid.

The solum is more than 60 inches thick.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is fine sandy loam or sandy loam. The A horizon is medium acid to neutral. The B2t horizon has hue of 7.5YR, value of 5 to 7, and chroma of 4 to 8. Mottles are in shades of white, red, yellow, or brown. The lower part of the B2t horizon, at a depth of more than 30 inches below the surface, has mottles with chroma of 2 or less. The B2t horizon is sandy clay loam or fine sandy loam. It is strongly acid to slightly acid. Some pedons have a C horizon of weakly consolidated sandstone or packsand.

Gasil Variant

The Gasil Variant consists of deep, well drained, moderately permeable soils that formed in loamy colluvium over tilted shale and siltstone. These very gently sloping to gently sloping soils are on foot slopes below higher ridges adjacent to the Arbuckle Mountains. Slopes range from 2 to 5 percent. The soils of the Gasil Variant are loamy-skeletal, siliceous, thermic Ultic Paleustalfs.

The Gasil Variant soils are associated with the Bromide, Chigley, and Travertine soils. Bromide soils are on side slopes of hills or ridges and have a solum that is less than 40 inches thick. Chigley soils are on ridgetops and side slopes and have a fine control section. Travertine soils are higher in elevation on similar landscape positions and are less than 40 inches thick over hard, tilted shale.

Typical pedon of Gasil Variant shaly silt loam, 2 to 5 percent slopes; 1,900 feet west and 400 feet south of the northeast corner of sec. 12, T. 2 S., R. 2 E.

A1—0 to 3 inches; light brownish gray (10YR 6/2) shaly silt loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, friable; common fine, medium, and coarse roots; many fine and medium pores; about 15 percent, by volume, fragments of shale and siltstone; slightly acid; clear smooth boundary.

A2—3 to 13 inches; light brown (7.5YR 6/4) shaly silt loam, brown (7.5YR 5/4) moist; weak fine granular structure; soft, friable; common fine, medium, and coarse roots; common fine and medium pores; about 20 percent, by volume, fragments of shale and siltstone; strongly acid; abrupt smooth boundary.

B21t—13 to 26 inches; reddish yellow (5YR 6/8) very shaly silty clay loam, yellowish red (5YR 5/8) moist; moderate medium blocky structure; hard, firm; clay films on faces of peds; few fine and medium roots; about 42 percent, by volume, fragments of shale and siltstone; very strongly acid, gradual smooth boundary.

B22t—26 to 40 inches; red (2.5YR 4/6) very shaly silt loam, dark red (2.5YR 3/6) moist; moderate coarse blocky structure; very hard, very firm; clay films on faces of peds; about 38 percent, by volume, fragments of shale and siltstone; very strongly acid; gradual smooth boundary.

B23t—40 to 65 inches; red (2.5YR 4/6) silty clay loam, dark red (2.5YR 3/6) moist; weak coarse blocky structure; extremely hard, extremely firm; clay films on faces of peds; about 2 percent, by volume, fragments of shale and siltstone; very strongly acid; gradual smooth boundary.

C—65 to 75 inches; red (2.5YR 5/6) silty clay loam, red (2.5YR 4/6) moist; massive; very hard, very firm; about 8 percent, by volume, fragments of shale and siltstone; very strongly acid.

Thickness of the solum is more than 60 inches. Depth to hard shale and siltstone is more than 72 inches.

The A1 horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 or 3. Coarse fragments make up 15 to 20 percent by volume. About 10 percent is less than 76 millimeters across, and 5 to 10 percent is more than 76 millimeters across. The A1 horizon is medium acid or slightly acid. The A2 horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 5. Its texture and content of coarse fragments are similar to those of the A1 horizon. The A2 horizon is strongly acid or medium acid.

The B21t and B22t horizons have hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 6 to 8. They are shaly silty clay loam, shaly silt loam, very shaly silty clay loam, or very shaly silt loam. Coarse fragments make up 35 to 70 percent by volume. About 10 to 35 percent is less than 76 millimeters across, and 25 to 35 percent is more than 76 millimeters across. The B21t and B22t horizons are very strongly acid or strongly acid.

The B23t and C horizons have hue of 2.5YR or 5YR, value of 3 to 5, and chroma of 4 to 6. They are silty clay loam, silt loam, shaly silty clay loam, or shaly silt loam. Coarse fragments make up 0 to 20 percent by volume. About 0 to 15 percent is less than 76 millimeters across, and 0 to 5 percent is more than 76 millimeters across. The B23t and C horizons are very strongly acid or strongly acid.

Grainola Series

The Grainola series consists of moderately deep, well drained soils that formed in mostly clayey material weathered from shale. Permeability is very slow. These sloping to moderately steep soils are on ridgetops and side slopes. Slopes are dominantly 8 to 15 percent but range from 5 to 20 percent. The soils of the Grainola series are fine, mixed, thermic Vertic Haplustalfs.

Grainola soils are associated with the Durant and Renfrow soils. Durant soils are on broad flats and side slopes of uplands; they are deeper and have a brownish argillic horizon. Renfrow soils are on the lower ridges and side slopes and have a solum that is more than 60 inches thick.

Typical pedon of Grainola cobbly clay loam, 5 to 20 percent slopes, eroded; 150 feet west and 25 feet south of the northeast corner of sec. 3, T. 1 S., R. 1 W.

A1—0 to 8 inches; reddish brown (5YR 4/4) cobbly clay loam, dark reddish brown (5YR 3/4) moist; moderate fine and medium granular structure; hard, firm; about 20 percent limestone cobbles by volume; calcareous; moderately alkaline; clear smooth boundary.

B2t—8 to 28 inches; red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; weak fine blocky structure; very hard, very firm; thick continuous clay films; about 10 percent, by volume, fragments of limestone; few soft bodies of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

Cr—28 to 60 inches; red (2.5YR 4/6) shaly clay, dark red (2.5YR 3/6) moist; many coarse prominent yellow (10YR 7/6) and very pale brown (10YR 7/3) spots; about 5 percent, by volume, fragments of limestone.

Thickness of the solum ranges from 20 to 40 inches.

The A horizon has hue of 5YR, value of 4 or 5, and chroma of 3 or 4. Fragments of limestone range from 15 to 30 percent by volume. The B horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6. It is clay. Fragments of limestone range from 5 to 10 percent by volume. The Cr horizon has colors similar to those of the B horizon.

Kingfisher Variant

The Kingfisher Variant consists of moderately deep, well drained, moderately permeable soils that formed in loamy material weathered from tilted limestone. These very gently sloping to sloping soils are on ridgetops of the Arbuckle Mountains. Slopes are smooth and range from 2 to 6 percent. The soils of the Kingfisher Variant are fine-silty, mixed, thermic Udic Argiustolls.

Kingfisher Variant soils are associated with Kiti, Norge Variant, Rayford, Scullin, and Timhill soils. Kiti and Norge Variant soils are on similar landscape positions. Kiti soils do not have an argillic horizon and are less than 20 inches thick over hard, tilted limestone. Norge Variant soils have a solum that is more than 60 inches thick over hard, tilted limestone. Rayford soils are on side slopes and foot slopes on the northern side of the Arbuckle Mountains. Rayford soils have a solum that is less than 20 inches thick over hard, limestone conglomerate bedrock and do not have an argillic horizon. Scullin soils are on side slopes and foot slopes on the southwestern side of the Arbuckle Mountains. Scullin soils have a fine control section. Timhill soils have a loamy-skeletal control section and a solum that is less than 20 inches thick over hard rhyolite. Timhill soils are on slightly higher areas of the landscape, and the native vegetation is post oak and blackjack oak and an understory of tall and mid grasses.

Typical pedon of Kingfisher Variant silt loam, in an area of Kingfisher Variant-Rock outcrop complex, 2 to 6 percent slopes; 1,100 feet north and 250 feet west of the southeast corner of sec. 29, T. 1 S., R. 1 E.

A1—0 to 12 inches; dark brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3/2) moist; moderate fine granular structure; hard, friable; slightly acid; gradual smooth boundary.

B1—12 to 16 inches; reddish brown (5YR 4/3) silty clay loam, dark reddish brown (5YR 3/3) moist; moderate medium granular structure; hard, friable; slightly acid; gradual smooth boundary.

B2t—16 to 35 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; moderate medium subangular blocky structure; hard, firm; clay films on faces of peds; few fine black concretions; few coarse fragments of limestone; slightly acid; clear irregular boundary.

R—35 to 40 inches; hard limestone bedrock; tilted 60 degrees from horizontal.

Thickness of the solum ranges from 20 to 40 inches.

The A horizon has hue of 7.5YR, value of 3 to 5, and chroma of 2 or 3. It is medium acid or slightly acid. The B1 horizon has hue of 5YR, value of 4 or 5, and chroma of 2 to 4. It is silt loam or silty clay loam. The B1 horizon is medium acid or slightly acid. The B2t horizon has hue of 5YR, value of 3 or 4, and chroma of 4 to 6. It is slightly acid or neutral. The lower part of the B2t horizon contains 0 to 10 percent, by volume, coarse fragments of limestone. The R layer is hard, tilted limestone. It is tilted more than 20 degrees from horizontal.

Kiti Series

The Kiti series consists of very shallow and shallow, well drained, moderately permeable soils that formed in loamy material weathered from tilted limestone. These very gently sloping to steep soils are on convex ridgetops and side slopes in the Arbuckle Mountains. Slopes range from 2 to 45 percent. The soils of the Kiti series are loamy-skeletal, mixed, thermic Lithic Haplustolls.

Kiti soils are associated with Kingfisher Variant, Norge Variant, Rayford, Scullin, and Timhill soils. Kingfisher Variant and Norge Variant soils are on landscape positions similar to those of the Kiti soils. Kingfisher Variant and Norge Variant soils have a solum that is more than 20 inches thick. Rayford soils are on side slopes and foot slopes on the northern side of the Arbuckle Mountains. Rayford soils have an abrupt smooth boundary over limestone conglomerate. Scullin soils are on side slopes and foot slopes on the southwestern side of the Arbuckle Mountains. Scullin soils have a solum that is more than 20 inches thick and have a fine control section. Timhill soils are on slightly higher areas of the landscape and are more acidic. In addition, Timhill soils formed over hard rhyolite, and the native vegetation is post oak and blackjack oak with an understory of tall and mid grasses.

Typical pedon of Kiti very flaggy loam, in an area of Kiti-Rock outcrop complex, 8 to 20 percent slopes; 2,200 feet west and 1,650 feet north of the southeast corner of sec. 10, T. 1 S., R. 3 E.

A11—0 to 5 inches; dark grayish brown (10YR 4/2) very flaggy loam, very dark grayish brown (10YR 3/2) moist; strong medium granular structure; hard, friable; about 35 percent, by volume, coarse flat fragments of limestone; calcareous; moderately alkaline; clear smooth boundary.

A12—5 to 12 inches; dark grayish brown (10YR 4/2) very flaggy loam, very dark grayish brown (10YR 3/2) moist; strong medium granular structure; hard, friable; about 45 percent, by volume, coarse flat fragments of limestone; calcareous; moderately alkaline; abrupt irregular boundary.

R—12 to 15 inches; hard fractured limestone bedrock; tilted 45 degrees from horizontal; fractures 6 inches to 3 feet apart and cracks more than 1 millimeter wide filled with soil material from the A12 horizon.

Thickness of the solum and depth to hard limestone bedrock range from 4 to 20 inches.

The A horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 or 3. It is very flaggy loam or very flaggy silty clay loam. Coarse, flat fragments of limestone range from 35 to 55 percent by volume. The A horizon is mildly alkaline or moderately alkaline. The R layer is hard limestone that is tilted 20 to 85 degrees from horizontal.

Konawa Series

The Konawa series consists of deep, well drained, moderately permeable soils that formed from mostly loamy alluvium. These nearly level to sloping soils are on high stream terraces. Slopes range from 0 to 8 percent. The soils of the Konawa series are fine-loamy, mixed, thermic Ultic Haplustalfs.

The Konawa soils in this survey area are taxadjuncts to the Konawa series. The B2t horizon is more alkaline than is typical for the Konawa series. Use, behavior, and management, however, are similar to those of the Konawa series.

Konawa soils are associated with Bastrop, Eufaula, and Teller soils. Bastrop and Teller soils are in similar areas adjacent to the flood plain of the Washita River. Bastrop soils have an argillic horizon that does not decrease in clay content by 20 percent at a depth of 60 inches below the surface. Teller soils have a mollic epipedon. Eufaula soils are in undulating or hummocky areas and have a sandy control section.

Typical pedon of Konawa fine sandy loam, 0 to 2 percent slopes; 1,700 feet west and 2,140 feet south of the northeast corner of sec. 11, T. 2 S., R. 2 E.

A11—0 to 8 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak fine granular structure; slightly hard, friable; many fine and medium roots; neutral; clear smooth boundary.

A2—8 to 16 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 4/4) moist; weak fine granular structure; slightly hard, friable; many fine and medium roots; mildly alkaline; clear smooth boundary.

B21t—16 to 22 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak fine subangular blocky structure parting to granular; slightly hard, friable; common fine and medium roots; patchy clay films on faces of peds; mildly alkaline; gradual smooth boundary.

B22t—22 to 46 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate medium subangular blocky structure; common fine roots; hard, firm; clay films bridging sand grains; mildly alkaline; gradual smooth boundary.

B23t—46 to 64 inches; red (2.5YR 5/8) sandy clay loam, red (2.5YR 4/8) moist; weak medium subangular blocky structure parting to weak coarse granular; slightly hard, friable; few fine roots; clay films bridging sand grains; slightly acid; gradual smooth boundary.

B3—64 to 78 inches; red (2.5YR 5/8) fine sandy loam, red (2.5YR 4/8) moist; weak medium granular structure; slightly hard, friable; slightly acid.

Thickness of the solum is 50 to more than 60 inches. The soil ranges from strongly acid to mildly alkaline throughout.

The A horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 4. It is fine sandy loam or loamy fine sand. The B2t or B3 horizons have hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 4 to 8. The B horizon is sandy clay loam or fine sandy loam.

Some pedons have a C horizon that has hue of 5YR, value of 5 or 6, and chroma of 6 to 8. It is fine sandy loam or loamy fine sand and ranges from strongly acid to neutral.

Konsil Series

The Konsil series consists of deep, well drained, moderately permeable soils that formed in loamy material weathered from weakly consolidated sandstone or packsand. These gently sloping soils are on side slopes of uplands, mainly in the southeastern part of the county. Slopes range from 3 to 5 percent. The soils of the Konsil series are fine-loamy, siliceous, thermic Ultic Paleustalfs.

Konsil soils are associated with Gasil soils. Gasil soils are commonly on ridgetops and have an argillic horizon with hue that is 7.5YR or more yellowish.

Typical pedon of Konsil fine sandy loam, 3 to 5 percent slopes; 1,600 feet west and 50 feet south of the northeast corner of sec. 22, T. 2 S., R. 3 E.

Ap—0 to 5 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak fine granular structure; hard, friable; slightly acid; clear smooth boundary.

A2—5 to 10 inches; pink (7.5YR 7/4) fine sandy loam, light brown (7.5YR 6/4) moist; weak fine granular structure; hard, friable; medium acid; clear smooth boundary.

B21t—10 to 36 inches; red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; moderate medium subangular blocky structure; hard, firm; clay films on faces of peds; strongly acid; gradual smooth boundary.

B22t—36 to 54 inches; red (2.5YR 5/8) sandy clay loam, red (2.5YR 4/8) moist; weak medium subangular blocky structure; hard, firm; clay films on faces of peds; strongly acid; gradual smooth boundary.

B3—54 to 72 inches; yellowish red (5YR 5/8) fine sandy loam, yellowish red (5YR 4/8) moist; weak medium granular structure; hard, friable; patchy clay films on faces of peds; strongly acid.

Thickness of the solum is more than 60 inches.

The Ap or A1 horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 4. It is medium acid or slightly acid. The A2 horizon has hue of 7.5YR or 10YR, value of 4 to 8, and chroma of 3 to 6. It is medium acid or slightly acid.

The B2t horizon has hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 4 to 8. It is strongly acid to slightly acid. The B3 horizon has hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 4 to 8. It is sandy clay loam or fine sandy loam. The B3 horizon is strongly acid to slightly acid.

Lula Series

The Lula series consists of deep, well drained, moderately permeable soils that formed in loamy material weathered from limestone. These very gently sloping soils are on broad uplands in the eastern part of the county. Slopes are 1 to 3 percent. The soils of the Lula series are fine-silty, mixed, thermic Typic Argiudolls.

The Lula soils in this survey area are taxadjuncts to the Lula series. They are slightly more alkaline in the upper horizons and are slightly drier than is typical for the Lula series. Use, behavior, and management, however, are similar to the Lula series.

Lula soils are associated with Catoosa, Claremore, Fitzhugh, and Shidler soils. Catoosa soils are on convex ridges and upper side slopes and have a solum that is 20 to 40 inches thick over hard limestone. Claremore soils are on ridge tops and upper side slopes and are less than 20 inches thick over hard limestone. Fitzhugh soils are on ridgetops and foot slopes and are fine-loamy. Shidler soils are very gently sloping to sloping; they are on ridges and are less than 20 inches thick over hard limestone.

Typical pedon of Lula silt loam, 1 to 3 percent slopes; 2,800 feet east and 1,800 feet south of the northwest corner of sec. 4, T. 1 S., R. 4 E.

A1—0 to 12 inches; brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3/2) moist; moderate medium granular structure; hard, friable; many fine and medium roots; neutral; clear smooth boundary.

B1—12 to 18 inches; reddish brown (5YR 4/3) silt loam, dark reddish brown (5YR 3/3) moist; moderate fine blocky structure; hard, firm; common fine and medium roots; neutral; gradual smooth boundary.

B21t—18 to 32 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; moderate medium blocky structure; very hard, very firm; common fine roots; thick continuous clay films on faces of peds; neutral; gradual smooth boundary.

B22t—32 to 47 inches; red (2.5YR 4/6) silty clay loam, dark red (2.5YR 3/6) moist; moderate medium blocky structure; very hard, very firm; few fine roots; thick continuous clay films on faces of peds; neutral; gradual smooth boundary.

B23t—47 to 58 inches; reddish brown (2.5YR 4/4) silty clay loam, dark reddish brown (2.5YR 3/4) moist; weak coarse blocky structure; very hard, very firm; thick continuous clay films on faces of peds; neutral; abrupt wavy boundary.

R—58 to 60 inches; hard limestone bedrock.

Thickness of the solum and depth to limestsone bedrock range from 40 to 60 inches. Thickness of the mollic epipedon ranges from 10 to 20 inches.

The A1 horizon has hue of 5YR to 10YR, value of 3 or 4, and chroma of 2 or 3. It is slightly acid or neutral. The B1 horizon has hue of 5YR to 10YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam, clay loam, or silty clay loam. The B1 horizon is slightly acid or neutral. The B2t horizon has hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silty clay loam or clay loam. The R layer is hard, fractured limestone bedrock that is tilted less than 20 degrees from horizontal.

McLain Series

The McLain series consists of deep, moderately well drained, slowly permeable soils that formed in loamy and clayey alluvium. These nearly level soils are on slightly concave benches of flood plains. Slopes are 0 to 1 percent. The soils of the McLain series are fine, mixed, thermic Pachic Argiustolls.

McLain soils are associated with Dale and Watonga soils. Dale soils are on the same flood plain but generally are nearer to the stream channel. They have a fine-silty control section. Watonga soils are on the same flood plain, have montmorillonitic mineralogy, and do not have an argillic horizon.

Typical pedon of McLain silty clay loam, rarely flooded; 2,700 feet south and 300 feet east of the northwest corner of sec. 30, T. 1 N., R. 2 E.

A1—0 to 24 inches; dark reddish brown (5YR 3/3) silty clay loam, dark reddish brown (5YR 3/2) moist; moderate medium granular structure; hard, friable; neutral; clear smooth boundary.

B2t—24 to 48 inches; yellowish red (5YR 5/6) silty clay loam, yellowish red (5YR 4/6) moist; moderate fine blocky structure; very hard, very firm; clay films on faces of peds; neutral; gradual smooth boundary.

B3—48 to 60 inches; red (2.5YR 5/6) silty clay, red (2.5YR 4/6) moist; weak medium blocky structure; very hard, very firm; patchy clay films on faces of peds; calcareous; moderately alkaline; gradual smooth boundary.

C—60 to 75 inches; red (2.5YR 5/8) silt loam, red (2.5YR 4/8) moist; massive; hard, friable; calcareous; moderately alkaline.

Thickness of the solum is 30 to more than 60 inches. Soft, powdery secondary carbonates are below a depth of 48 inches.

The A horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 2 or 3. The B2t horizon has hue of 2.5YR or 5YR, value of 3 to 5, and chroma of 3 to 6. The B3 horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6. The B2t and B3 horizons are silty clay loam or silty clay. The C horizon has hue of

2.5YR or 5YR, value of 4 to 6, and chroma of 3 to 8. It is silt loam, silty clay loam, or silty clay.

Naru Series

The Naru series consists of moderately deep, well drained, slowly permeable soils that formed in loamy material weathered from colluvium over shaly clay and indurated limestone conglomerate. These sloping to steep, savannah soils are on side slopes of low ridges or hills north of the Arbuckle Mountains. Slopes are dominantly 10 to 25 percent but range from 5 to 30 percent. The soils of the Naru series are loamy-skeletal, mixed, thermic Udic Haplustalfs.

The Naru soils are associated with the Bromide, Chigley, and Travertine soils. Bromide soils are on ridges and hills in the Arbuckle Mountains; they are moderately permeable and have tilted shale and siltstone at a depth of 20 to 44 inches. Chigley soils formed in material weathered from conglomerate and have a gravelly surface layer and a fine control section. Travertine soils are on shoulders and summits of hills and ridges in the Arbuckle Mountains; they are shallow over tilted shale and siltstone.

Typical pedon of Naru cobbly loam, in an area of Chigley-Naru complex, 5 to 30 percent slopes; 4,700 feet north and 4,000 feet east of the southwest corner of sec. 26, T. 1 S., R. 2 E.

A1—0 to 6 inches; brown (7.5YR 4/2) cobbly loam, dark brown (7.5YR 3/2) moist; moderate medium granular structure; soft, friable; common fine and medium roots; about 45 percent, by volume, coarse fragments of limestone; neutral; clear smooth boundary.

A2—6 to 15 inches; light brown (7.5YR 6/4) cobbly loam, brown (7.5YR 5/4) moist; moderate medium granular structure; soft, friable; common fine and medium roots; about 45 percent, by volume, coarse fragments of limestone; neutral; clear wavy boundary.

B2t—15 to 36 inches; reddish brown (5YR 5/4) cobbly loam, reddish brown (5YR 4/4) moist; moderate medium subangular blocky structure; hard, friable; few fine and medium roots; thick, nearly continuous clay films on faces of peds; about 35 percent, by volume, coarse fragments of limestone; neutral; clear wavy boundary.

IIC—36 to 58 inches; coarsely mottled dark reddish brown (2.5YR 3/4), reddish brown (5YR 4/4), gray (10YR 6/1), and olive yellow (2.5Y 6/6) shaly clay; massive; very hard, very firm; about 10 percent, by volume, coarse fragments of limestone; calcareous; moderately alkaline; clear wavy boundary.

IIR—58 to 70 inches; light gray (N 7/0) indurated limestone conglomerate; tilted less than 20 degrees from horizontal.

Thickness of the solum and depth to the IIC horizon range from 30 to 40 inches. Depth to the IIR layer ranges from 55 to 65 inches. Depth to secondary carbonates is more than 36 inches.

The A1 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 or 3. It is cobbly silt loam, very cobbly silt loam, cobbly loam, or very cobbly loam. The A1 horizon is medium acid to neutral. Content of coarse fragments of limestone ranges from 35 to 70 percent. About 15 to 30 percent is less than 76 millimeters across, and 20 to 40 percent, by volume, is more than 76 millimeters across. The A2 horizon has hue of 7.5YR or 10YR, value of 6 or 7, and chroma of 2 to 6. Its texture, reaction, and content of coarse fragments are similar to those of the A1 horizon.

The B2t horizon has hue of 5YR, value of 4 or 5, and chroma of 4 to 8. It is cobbly or very cobbly and is clay loam, silty clay loam, loam, or silt loam. The B2t horizon is medium acid to neutral. Its content of coarse fragments is similar to that of the A1 horizon.

The IIC horizon is coarsely mottled in shades of brown, red, gray, and yellow. The gray mottles are inherited from the parent material and are not indicative of wetness. Content of coarse fragments less than 76 millimeters across is 0 to 5 percent. The IIC horizon is neutral to moderately alkaline. Some pedons are noncalcareous.

The IIR layer is indurated limestone conglomerate that is several feet thick; it is tilted less than 20 degrees from horizontal. In some areas, minor amounts of granite fragments are in the conglomerate.

Norge Variant

The Norge Variant consists of deep, well drained, slowly permeable soils that formed in loamy and clayey material weathered from tilted limestone. These very gently sloping soils are on convex uplands in the Arbuckle Mountains. Slopes range from 1 to 3 percent. The soils of the Norge Variant are fine-silty, mixed, thermic Udic Paleustolls.

Norge Variant soils are associated with Kingfisher Variant, Kiti, Rayford, Scullin, and Timhill soils. Kingfisher Variant and Kiti soils are in similar landscape positions. Kingfisher Variant soils have a solum that is 20 to 40 inches thick over hard, tilted limestone. Kiti soils are less than 20 inches thick over hard, tilted limestone and do not have an argillic horizon. Rayford soils are on side slopes and foot slopes on the northern side of the Arbuckle Mountains; they have a solum that is less than 20 inches thick over hard limestone conglomerate. Scullin soils are on side slopes and foot slopes on the southwestern side of the Arbuckle Mountains; they have a solum that is 20 to 40 inches thick and have a fine control section. Timhill soils have a loamy-skeletal control section and a solum that is less than 20 inches thick over hard rhyolite. Timhill soils are on slightly higher parts of the landscape, and the native vegetation is post oak and blackjack oak with an understory of tall and mid grasses.

Typical pedon of Norge Variant silt loam, 1 to 3 percent slopes; 2,400 feet east and 500 feet south of the northwest corner of sec. 31, T. 1 S., R. 1 E.

A—0 to 12 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; hard, friable; common fine roots; slightly acid; clear smooth boundary.

B1—12 to 21 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; moderate fine blocky structure; hard, friable; common fine roots; slightly acid; gradual smooth boundary.

B21t—21 to 37 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; moderate medium blocky structure; hard, firm; few fine roots; thick continuous clay films on faces of peds; slightly acid; gradual smooth boundary.

B22t—37 to 55 inches; light reddish brown (5YR 6/4) clay loam, reddish brown (5YR 5/4) moist; moderate medium blocky structure; hard, firm; thick continuous clay films on faces of peds; slightly acid; gradual smooth boundary.

B3—55 to 75 inches; red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; weak coarse blocky structure; very hard, very firm; thick continuous clay films on faces of peds; about 10 percent, by volume, coarse fragments of limestone less than 76 millimeters across; slightly acid; abrupt irregular boundary.

R—75 to 80 inches; hard limestone; tilted 60 degrees from horizontal.

The solum is more than 60 inches thick.

The A horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 or 3. It ranges from medium acid to neutral. The B1 horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam, clay loam, or silty clay loam. The B2t horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 4 to 6. It is clay, clay loam, or silty clay loam. The B3 horizon has hue of 2.5YR or 7YR, value of 4 or 5, and chroma of 4 to 6. It is clay, silty clay, or silty clay loam. The B horizon ranges from medium acid to neutral.

Norge Variant soils differ from soils of the Norge series by having fragments of limestone in the lower part of the solum, being more clayey in the B3 horizon, and having an irregular boundary between the solum and the underlying limestone bedrock.

Rayford Series

The Rayford series consists of shallow, well drained, moderately permeable soils that formed in loamy material weathered from limestone conglomerate. These sloping to moderately steep soils are on uplands on the northern side of the Arbuckle Mountains. Slopes are dominantly 8 to 15 percent but range from 5 to 20 percent. The soils of the Rayford series are loamy-skeletal, mixed, thermic Lithic Haplustolls.

Rayford soils are associated with Kingfisher Variant, Kiti, Norge Variant, Scullin, and Timhill soils. Kingfisher Variant, Kiti, Norge Variant, and Timhill soils are in higher areas of the Arbuckle Mountains. Kingfisher Variant and Norge Variant soils have a solum that is less than 20 inches thick. Kiti soils have an irregular boundary over hard limestone that is tilted more than 20 degrees from horizontal. Scullin soils are on side slopes and foot slopes on the southwestern side of the Arbuckle Mountains. Scullin soils have a fine control section and a solum that is 20 to 40 inches thick. Timhill soils are at higher elevations, are more alkaline, and have a wavy boundary over hard rhyolite. They have native vegetation of post oak and blackjack oak with an understory of tall and mid grasses.

Typical pedon of Rayford cobbly loam, 5 to 20 percent slopes; 4,900 feet west and 1,800 feet north of the southeast corner of sec. 10, T. 1 S., R. 3 E.

A11—0 to 11 inches; dark grayish brown (10YR 4/2) cobbly loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; common fine and medium roots; few fine pores; about 30 percent, by volume, fragments of rounded limestone; calcareous; moderately alkaline; gradual smooth boundary.

A12—11 to 16 inches; brown (10YR 4/3) very cobbly clay loam, dark brown (10YR 3/3) moist; moderate medium granular structure; slightly hard, friable; few fine and medium roots; few fine pores; about 50 percent, by volume, fragments of rounded limestone; few soft bodies of calcium carbonate; calcareous; moderately alkaline; abrupt smooth boundary.

R—16 to 18 inches; indurated limestone conglomerate; tilted about 15 degrees from horizontal.

Thickness of the solum ranges from 8 to 20 inches. The average content of coarse fragments is more than 35 percent by volume.

The A11 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2. Content of limestone fragments ranges from 25 to 35 percent by volume. About 10 to 15 percent is less than 76 millimeters across, and 15 to 25 percent is more than 76 millimeters across. The A12 horizon has hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 or 3. It is cobbly loam, very cobbly loam, cobbly clay loam, very cobbly clay loam, cobbly silty clay loam or very cobbly silty clay loam. Content of limestone fragments ranges from 45 to 55 percent by volume. About 10 to 20 percent is less than 76 millimeters across, and 25 to 40 percent is more than 76 millimeters across. Films and soft bodies of calcium carbonate range from 0 to 5 percent by volume.

The R layer is indurated limestone conglomerate. It is tilted less than 20 degrees from horizontal.

Renfrow Series

The Renfrow series consists of deep, well drained soils that formed in clayey and loamy material weathered from clayey shale. Permeability is very slow. These very gently sloping to gently sloping soils are on uplands. Slopes range from 1 to 5 percent. The soils of the Renfrow series are fine, mixed, thermic Udertic Paleustolls.

Renfrow soils are associated with Durant and Grainola soils. Durant soils are on broad flats and side slopes and have a brownish argillic horizon. Grainola soils are on slightly higher side slopes and have a solum that is 20 to 40 inches thick.

Typical pedon of Renfrow silt loam, 1 to 3 percent slopes; 2,400 feet south and 1,600 feet east of the northwest corner of sec. 6, T. 1 S., R. 1 W.

A1—0 to 10 inches; reddish brown (5YR 4/3) silt loam, dark reddish brown (5YR 3/3) moist; moderate medium granular structure; hard, friable; neutral; clear smooth boundary.

B1—10 to 16 inches; reddish brown (5YR 4/3) silty clay loam, dark reddish brown (5YR 3/3) moist; moderate fine blocky structure; hard, firm; neutral; gradual smooth boundary.

B21t—16 to 38 inches; yellowish red (5YR 5/6) silty clay, yellowish red (5YR 4/6) moist; moderate medium blocky structure; very hard, very firm; thick continuous clay films on faces of peds; mildly alkaline; gradual smooth boundary.

B22t—38 to 48 inches; red (2.5YR 5/6) silty clay, red (2.5YR 4/6) moist; moderate coarse blocky structure; very hard, very firm; thick continuous clay films on faces of peds; moderately alkaline; gradual smooth boundary.

B3—48 to 62 inches; red (2.5YR 5/6) silty clay, red (2.5YR 4/6) moist; weak coarse blocky structure; very hard, very firm; patchy clay films on faces of peds; few fine soft rounded bodies of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Cr—62 to 70 inches; red (2.5YR 5/6) clayey shale, red (2.5YR 4/6) moist; massive; extremely hard, very firm; calcareous; moderately alkaline.

The solum is more than 60 inches thick. The soil ranges from neutral to moderately alkaline throughout.

The A horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 2 or 3. The B1 horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. It is silty clay loam or clay loam. The B2t horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6. It is clay or silty clay. The B3 horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 6 to 8. It is clay or silty clay. The Cr layer has hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 6 or 8.

The Renfrow soils in map unit 49 (Renfrow silt loam, 3 to 5 percent slopes) are taxadjuncts to the Renfrow series. They have a solum that is slightly thinner than is typical for the Renfrow series. This difference, however, does not significantly affect behavior, use, or management.

Scullin Series

The Scullin series consists of moderately deep, well drained soils that formed in mostly clayey material weathered from limestone. Permeability is moderately slow. These very gently sloping to sloping soils are on convex side slopes and foot slopes on the southwestern side of the Arbuckle Mountains. Slopes range from 2 to 6 percent. The soils of the Scullin series are fine, mixed, thermic Udic Argiustolls.

Scullin soils are associated with Kingfisher Variant, Kiti, Norge Variant, and Rayford soils. Kingfisher Variant, Kiti, and Norge Variant soils are on similar areas of the landscape. Kingfisher Variant and Norge Variant soils have a fine-silty control section. In addition, Norge Variant soils have a solum that is more than 60 inches thick. Kiti soils do not have an argillic horizon and have a solum that is less than 20 inches thick. Rayford soils are on side slopes and foot slopes on the northern side of the Arbuckle Mountains. Rayford soils do not have an argillic horizon and have a solum that is less than 20 inches thick.

Typical pedon of Scullin clay loam, in an area of Kiti-Scullin complex, 2 to 6 percent slopes; 2,700 feet east and 400 feet south of the northwest corner of sec. 6, T. 2 S., R. 1 W.

A—0 to 7 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; hard, friable; about 5 percent, by volume, coarse flat fragments of limestone; slightly acid; gradual smooth boundary.

B1—7 to 12 inches; dark brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate fine subangular blocky structure; hard, firm; about 5 percent, by volume, coarse flat fragments of limestone; slightly acid; gradual smooth boundary.

B21t—12 to 26 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate medium blocky structure; very hard, firm; clay films on faces of peds; about 10 percent, by volume, coarse flat fragments of limestone; slightly acid; gradual smooth boundary.

B22t—26 to 34 inches; yellowish red (5YR 5/6) flaggy clay, yellowish red (5YR 4/6) moist; weak coarse blocky structure; very hard, firm; patchy clay films on faces of peds; about 20 percent, by volume, coarse flat fragments of limestone; moderately alkaline; abrupt irregular boundary.

R—34 to 40 inches; hard fractured limestone; tilted 50 degrees from horizontal.

Thickness of the solum and depth to hard limestone bedrock ranges from 20 to 40 inches.

The A horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 or 3. Content of coarse flat fragments of limestone ranges from 3 to 10 percent by volume. The A horizon is medium acid or slightly acid.

The B1 horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. Content of coarse, flat fragments of limestone ranges from 5 to 15 percent by volume. The B1 horizon is medium acid or slightly acid. The B2t horizon has hue of 5YR or 2.5YR, value of 4 or 5, and chroma of 4 to 6. It is clay, flaggy clay, clay loam, or flaggy clay loam. Content of coarse, flat fragments of limestone ranges from 10 to 30 percent by volume. The B2t horizon ranges from slightly acid to moderately alkaline.

The R layer is hard, fractured limestone. It is tilted more than 20 degrees from horizontal.

Shidler Series

The Shidler series consists of very shallow and shallow, well drained, moderately permeable soils that formed in loamy material weathered from limestone. These very gently sloping to sloping soils are on broad uplands in the northeastern part of the county. Slopes range from 2 to 8 percent. The soils of the Shidler series are loamy, mixed, thermic Lithic Haplustolls.

Shidler soils are associated with Catoosa, Claremore, Clarita, Fitzhugh, and Lula soils. Catoosa and Claremore soils are on similar landscape positions and have an argillic horizon. Clarita soils are on side slopes, are deeper, and have a fine control section and montmorillonitic mineralogy. Fitzhugh soils are on low ridgetops and foot slopes and are fine-loamy. Lula soils are on broad uplands, are 40 to 60 inches thick, and have a fine-silty argillic horizon.

Typical pedon of Shidler silty clay loam, in an area of Shidler-Rock outcrop complex, 2 to 8 percent slopes; 400 feet south and 1,800 feet west of the northeast corner of sec. 4, T. 1 S., R. 4 E.

A1—0 to 8 inches; reddish brown (5YR 4/3) silty clay loam, dark reddish brown (5YR 3/3) moist; moderate medium granular structure; slightly hard, friable; common fine and medium roots; few fine pores; about 10 percent, by volume, flat fragments of limestone; neutral; abrupt smooth boundary.

R—8 to 10 inches; light gray (10YR 6/1) hard fractured flat-bedded limestone; fractures contain soil material similar to that of the A1 horizon.

Thickness of the solum ranges from 4 to 20 inches.

The A horizon has hue of 5YR to 10YR, value of 3 or 4, and chroma of 2 or 3. Content of coarse flat fragments of limestone ranges from 0 to 15 percent by volume. About 0 to 10 percent is less than 76 millimeters across, and 5 to 10 percent is more than 76 millimeters across. The A horizon is slightly acid to moderately alkaline. The R layer is grayish, hard, fractured limestone that is tilted less than 20 degrees from horizontal.

Stephenville Variant

The Stephenville Variant consists of moderately deep, well drained, moderately permeable soils that formed in loamy material weathered from tilted sandstone. These gently sloping to moderately steep soils are on rolling hillsides and upper foot slopes. Slopes are complex and range from 3 to 20 percent. The soils of the Stephenville Variant are fine-loamy, siliceous, thermic Ultic Haplustalfs.

Stephenville Variant soils are associated with Darnell Variant soils. Darnell Variant soils are on ridgetops and are less than 20 inches thick over sandstone.

Typical pedon of Stephenville Variant fine sandy loam, 3 to 5 percent slopes; 3,000 feet north and 1,400 feet west of the southeast corner of sec. 9, T. 1 S., R. 4 E.

A1—0 to 6 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; slightly acid; gradual smooth boundary.

A2—6 to 14 inches; light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; weak fine granular structure; soft, very friable; slightly acid; clear smooth boundary.

B21t—14 to 24 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak medium subangular blocky structure; hard, firm; clay films on faces of peds; medium acid; diffused smooth boundary.

B22t—24 to 36 inches; yellowish red (5YR 5/8) sandy clay loam, yellowish red (5YR 4/8) moist; weak coarse subangular blocky structure; hard, friable; clay films on faces of peds and bridging sand grains; medium acid; abrupt irregular boundary.

R—36 to 40 inches; reddish brown (5YR 5/4) indurated sandstone; tilted 30 degrees from horizontal.

Thickness of the solum ranges from 20 to 40 inches.

The A1 horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 or 4. The A2 horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2 to 4. The A horizon is medium acid or slightly acid. The B2t horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 4 to 8. It is sandy clay loam or fine sandy loam and is strongly acid to slightly acid. The R layer is reddish or brownish indurated sandstone that is tilted more than 20 degrees from horizontal.

Teller Series

The Teller series consists of deep, well drained, moderately permeable soils that formed in loamy sediment. These nearly level to very gently sloping soils are on high stream terraces near the Washita River. Slopes range from 0 to 3 percent. The soils of the Teller series are fine-loamy, mixed, thermic Udic Argiustolls.

Teller soils are associated with Bastrop and Konawa soils. The Bastrop soils are on higher stream terraces, and the Konawa soils are in lower positions. Bastrop and Konawa soils do not have a mollic epipedon. In addition, Bastrop soils have an argillic horizon that does not decrease in clay content by 20 percent from the maximum within a depth of 60 inches.

Typical pedon of Teller loam, 1 to 3 percent slopes; 1,900 feet south and 500 feet east of the northwest corner of sec. 26, T. 2 N., R. 1 E.

Ap—0 to 10 inches; brown (7.5YR 5/2) loam, dark brown (7.5YR 3/2) moist; moderate fine granular structure; soft, friable; many fine and medium roots; slightly acid; clear smooth boundary.

B1—10 to 22 inches; reddish brown (5YR 5/4) loam, reddish brown (5YR 4/4) moist; moderate fine blocky structure; slightly hard, friable; common fine and medium roots; slightly acid; gradual smooth boundary.

B21t—22 to 38 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate medium blocky structure; hard, firm; few fine roots; clay films on faces of peds; slightly acid; gradual smooth boundary.

B22t—38 to 55 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate coarse blocky structure; hard, firm; clay films on faces of peds; slightly acid; gradual smooth boundary.

B3—55 to 75 inches; yellowish red (5YR 5/8) fine sandy loam, yellowish red (5YR 4/8) moist; weak coarse blocky structure; hard, firm; patchy clay films on faces of peds; slightly acid.

The solum is more than 60 inches thick.

The A horizon has hue of 7.5YR, value of 4 or 5, and chroma of 2 or 3. It is medium acid or slightly acid. The B1 horizon has hue of 5YR, value of 4 or 5, and chroma of 2 to 4. The B2t horizon has hue of 5YR, value of 4 or 5, and chroma of 4 to 8. It is clay loam or sandy clay loam. The B1 and B2t horizons are medium acid or slightly acid. The B3 horizon has colors similar to those of the B2t horizon. It is loam or fine sandy loam. The B3 horizon is slightly acid or neutral.

Timhill Series

The Timhill series consists of shallow, well drained, moderately permeable soils that formed in loamy material weathered from tilted rhyolite. These sloping to steep soils are on ridgetops and upper side slopes of the Arbuckle Mountains. Slopes are complex; they are dominantly 5 to 25 percent but range to 30 percent. The soils of the Timhill series are loamy-skeletal, mixed, thermic Lithic Haplustolls.

Timhill soils are associated with the Kingfisher Variant, Kiti, Norge Variant, and Rayford soils. Kingfisher Variant, Kiti, and Norge Variant soils are on slightly lower areas of the landscape. Kingfisher Variant and Norge Variant soils have an argillic horizon and a solum that is more than 20 inches thick. Kiti soils have an irregular boundary over hard limestone that is tilted more than 20 degrees from horizontal. Rayford soils are on side slopes and foot slopes on the northern side of the Arbuckle Mountains. Rayford soils are more alkaline than Timhill soils.

Typical pedon of Timhill stony silt loam, 5 to 30 percent slopes; 1,300 feet south and 800 feet west of the northeast corner of sec. 1, T. 2 S., R. 1 E.

A1—0 to 7 inches; dark brown (10YR 3/3) stony silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; hard, very friable; many fine and few medium roots; many fine and medium pores; about 35 percent, by volume, rhyolite fragments; neutral; gradual wavy boundary.

B2—7 to 15 inches; brown (7.5YR 4/2) very gravelly silt loam, dark brown (7.5YR 3/2) moist; moderate medium and fine granular structure; hard, friable; few fine and medium roots; about 40 percent, by volume, rhyolite fragments; neutral; clear wavy boundary.

C—15 to 18 inches; yellowish red (5YR 5/6) very gravelly loam, yellowish red (5YR 4/6) moist; massive; few fine roots; about 85 percent, by volume, rhyolite fragments; slightly acid; abrupt irregular boundary.

R—18 to 30 inches; indurated rhyolite; tilted 40 degrees from horizontal.

Thickness of the solum ranges from 9 to 17 inches Depth to indurated rhyolite bedrock ranges from 10 to 20 inches.

The A horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 or 3. It is stony silt loam or stony loam. Content of coarse fragments is 25 to 50 percent by volume. About 15 to 25 percent is less than 76 millimeters across, and 10 to 25 percent is more than 76 millimeters across. The A horizon is medium acid to neutral.

The B horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4. It is very gravelly loam, very gravelly silt loam, cobbly silt loam, or cobbly loam. Content of coarse fragments is 35 to 65 percent by volume. About 35 to 50 percent is less than 76 millimeters across, and 0 to 15 percent is more than 76 millimeters across. The B horizon is medium acid to neutral.

The C horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6. It is very gravelly loam. Coarse fragments less than 76 millimeters across make up 80 to 90 percent of the horizon by volume. The C horizon is slightly acid.

The R layer is indurated rhyolite. It is tilted more than 20 degrees from horizontal.

Travertine Series

The Travertine series consists of shallow, well drained, moderately permeable soils that formed in loamy material weathered from tilted, platy shale and siltstone. These sloping savannah soils are on shoulders and summits of hills or ridges in the Arbuckle Mountains. Slopes are 5 to 8 percent. The soils of the Travertine series are loamy-skeletal, siliceous, thermic, shallow Udic Ustochrepts.

The Travertine soils are associated with the Bromide, Chigley, Gasil Variant, and Naru soils. Bromide soils are on side slopes, have a solum that is 20 to 40 inches thick, and have an argillic horizon. Chigley soils are on ridgetops and side slopes and have more than 35 percent clay in the control section. Gasil Variant soils are on foot slopes and have a solum that is more than 60 inches thick. Naru soils are on low hills and ridges. They are slowly permeable and have limestone conglomerate at a depth of 55 to 65 inches.

Typical pedon of Travertine channery silt loam, in an area of Travertine-Bromide complex, 5 to 25 percent slopes; 1,350 feet west and 650 feet north of the southeast corner of sec. 1, T. 2 S., R. 2 E.

A1—0 to 13 inches; pale brown (10YR 6/3) channery silt loam, brown (10YR 4/3) moist; weak fine granular structure; soft, friable; common medium and coarse roots; many fine and medium pores; about 35 percent, by volume, flat fragments of shale and siltstone; slightly acid; gradual wavy boundary.

B2—13 to 18 inches; pink (7.5YR 7/4) extremely channery loam, brown (7.5YR 5/4) moist; weak fine granular structure; soft, friable; few fine and medium roots; about 70 percent, by volume, flat fragments of shale and siltstone; neutral; clear wavy boundary.

Cr—18 to 26 inches; platy siliceous shale and siltstone; tilted 60 degrees from horizontal.

Thickness of the solum and depth to shale and siltstone bedrock range from 10 to 20 inches.

The A horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. It is channery silt loam or channery loam. Content of coarse flat fragments is 20 to 35 percent by volume. About 10 to 20 percent is less than 76 millimeters across, and 10 to 20 percent is more than 76 millimeters across. The A horizon is medium acid or slightly acid.

The B horizon has hue of 7.5YR, value of 5 to 7, and chroma of 4. It is extremely channery silt loam or extremely channery loam. Content of coarse flat fragments is 60 to 85 percent by volume. About 10 to 20 percent is less than 76 millimeters across, and 50 to 70 percent is more than 76 millimeters across. The B horizon is medium acid to neutral.

The Cr horizon is platy, siliceous shale and siltstone. It is tilted more than 20 degrees from horizontal.

Tussy Series

The Tussy series consists of moderately deep, well drained soils that formed in clayey material weathered from calcareous shale (fig. 14). Permeability is very slow. These very gently sloping to steep soils are on convex summits and side slopes of uplands. Slopes are dominantly 3 to 20 percent but range from 2 to 30 percent. The soils of the Tussy series are fine, montmorillonitic, thermic Vertic Ustochrepts.

Tussy soils are associated with Chigley and Clarita soils. Chigley soils are on ridgetops and side slopes. They have an argillic horizon and a solum that is 40 to 60 inches thick over cemented conglomerate of sandstone, quartz, and limestone fragments. Clarita soils are on convex summits, have an A horizon that has chroma of 1 or less, and have cyclic properties.

Typical pedon of Tussy clay, 5 to 30 percent slopes, eroded; 2,300 feet north and 700 feet east of southwest corner of sec. 19, T. 2 N., R. 3 E.

Ap—0 to 8 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; weak coarse granular structure; hard, firm; common fine roots; few soft bodies and concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B2ca—8 to 26 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate coarse blocky structure; very hard, very firm; few fine roots; few nonintersecting slickensides; cracks 1/4 inch wide and 28 inches deep; about 15 percent, by volume, soft bodies and concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C—26 to 60 inches; yellowish red (5YR 5/8) clay, yellowish red (5YR 4/8) moist; massive; about 40 percent, by volume, soft bodies and concretions of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum ranges from 20 to 40 inches. Depth to bedrock is more than 60 inches.

The A horizon has hue of 2.5YR to 7.5YR, value of 3 to 5, and chroma of 2 to 4. The B2ca horizon has hue of 10R to 5YR, value of 3 to 5, and chroma of 3 to 6. It is clay or silty clay ranging from 40 to 50 percent clay. Soft bodies and concretions of calcium carbonate range from

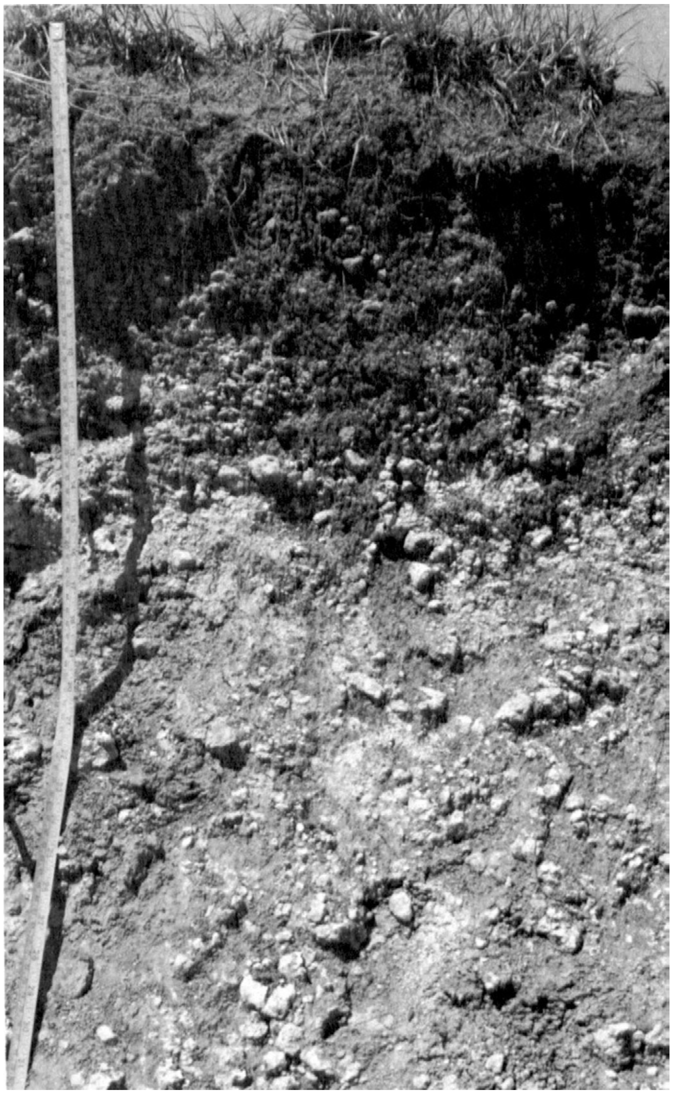


Figure 14.—A profile of Tussy clay showing the reddish brown clay surface layer and the calcareous clay subsoil.

10 to 40 percent by volume. Nonintersecting slickensides are in some pedons.

The C horizon has hue of 10R to 5Y, value of 3 to 6, and chroma of 3 to 8. It is clay or shaly clay. Soft bodies and concretions of calcium carbonate range from 25 to 50 percent by volume.

Watonga Series

The Watonga series consists of deep, moderately well drained soils that formed from clayey and loamy alluvium,. Permeability is very slow. These nearly level soils are on flood plains of the Washita River. Slopes are plane and mainly less than 1 percent, but occasional concave areas are present. The soils of the Watonga series are fine, montmorillonitic, thermic Udic Pellusterts.

Watonga soils are associated with the Dale and McLain soils. Dale and McLain soils are on the same flood plain as the Watonga soils, but they commonly are nearer to the stream channel. Dale soils have a fine-silty control section. McLain soils have mixed mineralogy and do not have vertic properties.

Typical pedon of Watonga clay, rarely flooded; 1,100 feet north and 500 feet east of the southwest corner of sec. 26, T. 2 N., R. 1 E.

A1—0 to 20 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate medium subangular blocky structure; hard, firm; moderately alkaline; gradual wavy boundary.

AC—20 to 50 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; weak coarse blocky structure; very hard, very firm; shiny pressure faces on peds; few intersecting slickensides; dark soil material in some cracks; calcareous; moderately alkaline; gradual wavy boundary.

C—50 to 75 inches; reddish brown (5YR 5/3) clay, reddish brown (5YR 4/3) moist; massive; hard, firm; calcareous; moderately alkaline.

The solum is 40 to 60 inches thick. When dry, this soil has cracks ranging from 1 centimeter to 2 centimeters in width at a depth of 20 inches. The A horizon is as thin as 14 inches in the microhighs and as thick as 40 inches in the microlows.

The A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 1. It is clay or silty clay loam. The A1 horizon is neutral to moderately alkaline. The AC horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 to 4. In some pedons, the AC horizon has reddish and brownish mottles. The AC horizon is clay, clay loam, or silty clay. Most pedons have cracks in the AC horizon that are filled with dark material similar to that of the A horizon. The C horizon has hue of 5YR to 10YR, value 4 or 5, and chroma of 3 or 4. It is clay, clay loam, or silty clay loam.

Wilson Series

The Wilson series consists of deep, somewhat poorly drained, very slowly permeable soils that formed in alkaline, clayey old alluvium or nearly impervious marine clay. These nearly level soils are on uplands or high stream terraces. Slopes are dominantly 0 to 1 percent; there are a few depressed or concave areas. The soils of the Wilson series are fine, montmorillonitic, thermic Vertic Ochraqualfs.

Wilson soils are associated with the Clarita and Durant soils. Clarita soils are on broad ridges and side slopes;

they have a solum that has intersecting slickensides below the surface layer. Durant soils are on nearly level to gently sloping uplands; they have a mollic epipedon.

Typical pedon of Wilson silt loam, 0 to 1 percent slopes; 500 feet north and 400 feet west of the southeast corner of sec. 16, T. 1 S., R. 4 E.

Ap—0 to 8 inches; gray (10YR 5/1) silt loam, dark gray (10YR 4/1) moist; weak fine granular structure; hard, friable; slightly acid; abrupt wavy boundary.

B21tg—8 to 24 inches; dark gray (10YR 4/1) silty clay loam; moderate medium blocky structure; hard, firm; clay films of faces of peds; vertical cracks filled with gray (10YR 5/1) silt loam; slightly acid; gradual wavy boundary.

B22tg—24 to 44 inches; light gray (2.5Y 7/2) silty clay, light brownish gray (2.5Y 6/2) moist; common distinct olive (5Y 4/3) mottles; moderate coarse blocky structure; very hard, very firm; clay films on faces of peds; vertical cracks filled with dark gray (10YR 4/1) silty clay loam; moderately alkaline; gradual smooth boundary.

C—44 to 80 inches; light gray (N 7/0) silty clay, gray (N 6/0) moist; many coarse yellowish brown (10YR 5/4) mottles; massive; extremely hard, extremely firm; calcareous; moderately alkaline.

Thickness of the solum ranges from 40 to 80 inches. This soil has a perched water table in the upper 12 inches during the winter and spring. During dry periods, vertical cracks from 1 centimeter to 2 centimeters wide extend from the top of the B horizon to a depth of 20 inches or more.

The A horizon has hue of 10YR to 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is slightly acid or neutral. The B21t horizon has hue of 10YR, value of 4 or 5, and chroma of 1. It is silty clay loam or silty clay. The B21t horizon is slightly acid or neutral. The B22t horizon has hue of 10YR to 2.5Y, value of 5 to 7, and chroma of 1 or 2. It is silty clay or clay. The B22t horizon is neutral to moderately alkaline. The C horizon has hue of 5Y or 2.5Y, value of 5 to 7, and chroma of 0 to 2. It is coarsely mottled in shades of yellow, brown, or red. The C horizon is silty clay or clay and is neutral to moderately alkaline.

Yahola Series

The Yahola series consists of deep, well drained soils that formed in slightly altered, loamy, calcareous alluvium. Permeability is moderately rapid. These nearly level soils are on flood plains. Slopes are convex to concave and mainly less than 1 percent. The soils of the Yahola series are coarse-loamy, mixed (calcareous), thermic Typic Ustifluvents.

Yahola soils are associated with Dale soils on the same flood plain in higher-lying positions. Dale soils have a mollic epipedon and a fine-silty control section.

Typical pedon of Yahola fine sandy loam, occasionally flooded; 1,700 feet west and 400 feet south of the northwest corner of sec. 2, T. 1 N., R. 1 E.

Ap—0 to 4 inches; brown (7.5YR 5/2) fine sandy loam, dark brown (7.5YR 4/2) moist; weak fine granular structure; hard, friable; many fine and medium roots; calcareous; moderately alkaline; clear smooth boundary.

A1—4 to 18 inches; yellowish red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) moist; weak fine granular structure; hard, friable; many fine and medium roots; calcareous; moderately alkaline; gradual smooth boundary.

C1—18 to 50 inches; reddish yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6) moist; massive; slightly hard, very friable; thin strata of silt loam; calcareous; moderately alkaline; clear smooth boundary.

C2—50 to 72 inches; reddish brown (5YR 5/4) silt loam, reddish brown (5YR 4/4) moist; massive; hard, firm; calcareous; moderately alkaline.

The A horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 2 to 6. It is fine sandy loam or loamy fine sand. The A horizon is mildly alkaline or moderately alkaline and calcareous.

The C horizon has hue of 2.5YR or 5YR, value of 5 or 6, and chroma of 4 to 8. It is fine sandy loam above a depth of 40 inches and fine sandy loam, loam, silt loam, or loamy fine sand below a depth of 40 inches. Thin strata of finer or coarser material occur throughout the C horizon.

Geology of Murray County

Kenneth S. Johnson, Oklahoma Geological Survey, The University of Oklahoma, helped to prepare this section.

The geology of Murray County is complex. (See the generalized geology map and geologic cross-section immediately following the tables.) The county embraces the main elements of the Arbuckle Mountains, a classic region of the south-central United States. Geologists have conducted field studies of rock units that contain major petroleum reserves in the nearby subsurface of Oklahoma and surrounding states.

The Arbuckle Mountains are an area of low to moderate hills containing about 12,000 feet of folded and faulted sedimentary rocks. The rocks range from Cambrian (about 500 million years old) to Pennsylvanian (about 300 million years old). Nearly 80 percent of these sedimentary rocks are limestones and dolomites, and the remainder are shales and sandstones. Rocks in the Arbuckle Mountains were thrust upward and were folded and faulted during several mountain-building episodes in the Pennsylvanian Period. This has imparted the moderate-to-steep dip that characterizes the strata that crop out in the mountain area (fig. 15).

In contrast to the complex geology within the Arbuckle Mountains, the central and northern parts of Murray County are characterized by flat-lying, Late Pennsylvanian and Permian shales, sandstones, and conglomerates. These were deposited north of the mountains about 300 to 275 million years ago, during and after the mountain-building episodes.

The Murray County area was inundated by shallow seas many times during deposition of these sediments. There are abundant marine fossils, such as trilobites, brachiopods, clams, snails, and others, in most of the sedimentary rocks that crop out in the county. Marine invasions occurred intermittently from Cambrian through Pennsylvanian time, but the water withdrew from the area about 300 million years ago, when the Arbuckle Mountains were folded and thrust upward out of the seas.

Although most of the outcropping rocks in Murray County are of sedimentary origin, the oldest exposed rocks are Cambrian-age igneous rocks, called the Carlton (or Colbert) Rhyolite. The Carlton Rhyolite consists of several thousand feet of lava flows that spread across the entire southern half of the county. These are the so-called "basement rock" upon which the younger sedimentary rocks rest in this part of the county. The rhyolite crops out only in the East and West Timbered Hills, areas along the axis of the Arbuckle Mountain uplift. Rhyolite is very resistant to weathering and erosion. The soils that developed on this rock type are shallow, well drained, loamy soils on ridgetops and side slopes of the two timbered hills areas. These soils are in the Kiti-Rock outcrop-Rayford general soil map unit.

Overlying the Carlton Rhyolite are the Timbered Hills Group (500 feet thick) and the Arbuckle Group (6,500 feet thick) of Late Cambrian and Early Ordovician age. This sequence, dominated by the Arbuckle Group, comprises one of the world's greatest deposits of limestone and dolomite. Originally deposited as horizontal layers on the sea floor, these and other strata of the Arbuckle Mountains were folded and tilted during later mountain-building episodes. Now, they typically dip at moderate to steep angles. Alternating layers of limestone in the Arbuckle Group have differing composition and differing resistance to erosion. The weakly resistant layers are readily weathered into furrows between the adjacent hard layers, creating the "tombstone topography" that is characteristic of the Arbuckle Mountains. Soils developed on the Timbered Hills Group and Arbuckle Group limestones and dolomites are in the Kiti-Rock outcrop-Rayford general soil map unit. Typically, they are well drained, loamy soils on ridgetops and side slopes.

Above the Arbuckle Group are some 5,000 feet of alternating limestones, sandstones, and shales of Middle Ordovician through Mississippian age. These strata include, in ascending order, the Simpson Group, Viola Limestone, Sylvan Shale, Hunton Group, Woodford Shale, Sycamore Limestone, Delaware Creek Shale, and Goddard Shale. In the western half of Murray County, these rock units are steeply dipping; the soils developed on them are in the Kiti-Rock outcrop-Rayford general soil map unit. In the eastern part of the county, the strata are steeply dipping or flat-lying; among the dominant soils developed in these areas are the soils of the Clarita-Durant-Burleson, Shidler-Claremore-Clarita, Fitzhugh-Lula, Kiti-Rock outcrop-Rayford, and Chigley-Travertine-Naru general soil map units.

Following development of the Arbuckle Mountains during the Pennsylvanian Period, several thousand feet of shales, sandstones, and conglomerates were deposited as flat-lying strata in and around the mountain

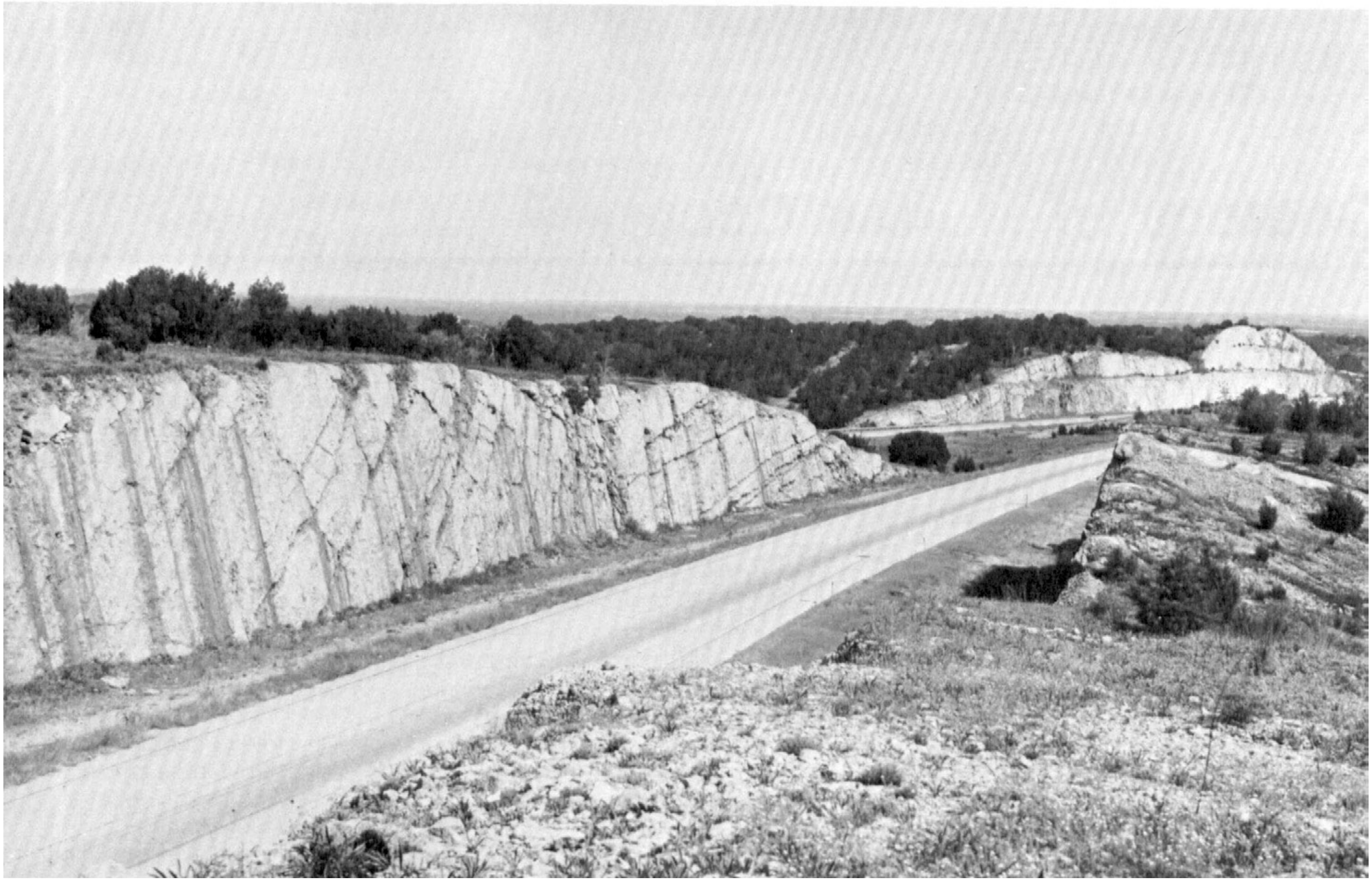


Figure 15.—A road cut in the Arbuckle Mountains reveals the characteristic tilting of the geological formations. This road cut is in an area of Kiti-Rock outcrop complex, 8 to 20 percent slopes.

area. These strata include the Late Pennsylvanian Ada Group (Collings Ranch Conglomerate), Vanoss Group, and Oscar Group and the Early Permian Wellington Formation. Soils formed on these units commonly are deep, gently sloping to strongly sloping, moderately well drained, and loamy or clayey; they are in the Clarita-Durant-Burleson, Shidler-Claremore-Clarita, and Chigley-Clarita general soil map units.

Quaternary alluvial and terrace deposits of Murray County generally are 10 to 100 feet thick. They consist mainly of sand, gravel, and clay eroded from the Arbuckle Mountains and from outcropping Permian and Pennsylvanian strata north and northwest of the county. Quaternary sediments, generally deposited within the past million years, were laid down mainly as flood plain or alluvial deposits along major rivers and streams flowing to the south and southeast across the county. These deposits produced soils of the Garvin-Elandco, Yahola-Dale, Watonga-McLain, and Bastrop-Gasil-Konawa general soil map units. These are deep, nearly level, and well drained and may be clayey, loamy, or sandy depending on the local character of the alluvium.

The rock, mineral, and water resources of Murray County are great, and their development is extremely important in the development and progress of the county. Great reserves of limestone and dolomite are available for production of crushed stone, riprap, and cement. The county currently leads the State in limestone production; current production is about 5 million short tons per year, nearly 20 percent of the entire State's production. High-purity silica sand is an untapped resource in the county, but deposits similar to those currently being worked at nearby Mill Creek and Roff are available for future development. Petroleum production in the county during 1980 was about 1.8 million barrels of crude oil and about 270 million cubic feet of natural gas. This ranks Murray County below the middle as a petroleum-producing county in the State. Large reserves of tar sand, asphaltic sandstone, and asphaltic limestone are present between Sulphur and

Dougherty. These resources supported a strong asphalt industry during the first half of this century, and they could again be developed as a source of heavy oil. Good quality ground water exists in the limestone and sandstone aquifers of the Arbuckle and Simpson Groups in the mountain area, and in sand and gravel aquifers of the Quaternary alluvium and terrace deposits.

Factors of Soil Formation

The characteristics of the soil at any given point are determined by—

- the physical properties and mineralogical composition of the parent material,
- the climate under which the parent material has existed since accumulation,
- the plant and animal life on and in the soil,
- the relief, or lay of the land, and
- the length of time that the factors of soil development have acted on the parent material.

Few generalizations can be made regarding the effects of any one factor because its effects are modified by the other four.

Parent Material

Parent material is the unconsolidated material from which soil is formed. It is one of the major factors of soil formation in the county. Parent material establishes the limits of the physical properties and chemical and mineral composition of the soil, and it influences the rate of soil development.

The parent materials of the county fall into two classes, residual and transported. Residual parent material formed in place from the weathering of consolidated bedrock. Transported parent material is unconsolidated material that has been moved by wind or water from the site of its parent bedrock and redeposited.

Climate

The moist, subhumid, continental climate of Murray County is characterized by high-intensity rainfall. Moisture and warm temperatures have promoted the formation of distinct horizons in many of the soils. Differences in soils, however, cannot be attributed to climate because the climate is uniform throughout the county.

Heavy rains have caused rapid runoff that has eroded many of the soils. This erosion is an indirect effect of climate.

Plants and Animals

Plants, burrowing animals, insects, and microorganisms have a direct influence on the formation of soil. For example, native vegetation influences the amount of organic matter, the amount and kind of plant nutrients, and soil structure. Prairie vegetation adds more organic matter to the soil, causes a stronger grade of structure to develop in the A horizon, and recycles more nutrients to the upper horizons than does forest vegetation. For example, the Durant and Norge Variant soils, which formed under prairie vegetation, have a thicker, darker A horizon that has a more developed granular structure and is richer in nutrients than do the Gasil and Stephenville soils, which formed under forest vegetation.

During the past century, man has altered the effects of this soil-forming factor by removing the native vegetation over much of the county. The lack of adequate conservation measures has resulted in much soil loss through sheet and gully erosion. Where some of the surface layer has been removed and gullies have formed, eroded phases of soils are mapped. An example is Bastrop and Konawa soils, 3 to 8 percent slopes, gullied.

Relief

Relief affects soil formation through its influence on moisture, drainage, erosion, temperature, and plant cover. The relief of Murray County is determined largely by the varying resistance of the underlying bedrocks to weathering and geologic erosion.

The effects of relief on soil formation can be illustrated by contrasting the Durant and Kiti soils. Durant soils are in areas of less sloping relief than the Kiti soils. Durant soils have a thicker solum that has more developed horizons than do Kiti soils. The difference is primarily the result of the Durant soils having less surface runoff and more water percolating into the soil. This affects the loss, gain, or transfer of soil constituents.

Time

Time as a factor cannot be measured only in years. The length of time needed for the development of genetic horizons depends on the intensity and the interactions of the soil-forming factors in promoting the loss, gain, transfer, or transformation of soil constituents that are necessary to form soil horizons. Soils that do not have definite horizons are young or immature. Mature soils have approached equilibrium with their environment and tend to have well defined horizons.

The soils of Murray County range from young to old. Some of the mature soils are the Durant and Wilson soils on uplands. Bastrop and Teller soils are younger but they, too, have clearly defined horizons. Rafford soils are young soils; because they are sloping, geologic erosion has removed soil material almost as fast as it has formed. Yahola and Elandco soils on flood plains have been developing for such a short time that they show little development of horizons.

Active Processes of Soil Formation

Active processes that have influenced the formation of horizons in the soils of Murray County are accumulation of organic matter, leaching of calcium carbonate and bases, and translocation of silicate clay minerals. In most soils, more than one of these processes have been active.

Prairie vegetation adds more organic matter to the surface layer and contributes to a more developed granular structure than does forest vegetation. Durant soils formed under prairie vegetation, and they have a surface layer that is high in content of organic matter. This kind of surface layer is called a mollic epipedon. Gasil soils formed under forest vegetation and contain less organic matter than Durant soils. Their surface layer is called an ochric epipedon.

Leaching of carbonates and bases is active in the formation of soils. The accumulation of bases in the lower part of the AC horizon of Tussy soils indicates the depth to which water has percolated. Gasil soils have leached to the extent that they lack accumulation of calcium carbonate. Also, more bases have been leached from the B horizon of Stephenville soils; this is reflected by their base saturation. Soils on flood plains, such as Elandco soils, are recharged with bases when flooding occurs. Renfrow soils, which formed over shales, are high in bases.

The translocation of silicate clay minerals is a very important factor affecting the properties and classification of soils. Clay films on faces of peds, clay bridging sand grains, and an increase in total clay are evidence of an argillic horizon. The varying degrees of translocation of silicate clay minerals and the kind of parent material in which a soil formed have resulted in wide variations in the texture and other properties of the argillic horizon in different soils. Gasil and Konsil soils have a sub-subsurface layer that is more intensely leached of silicate clay minerals than the surface layer of other soils in the county.

Prairie vegetation brings bases to the surface. This retards leaching and the formation of an A2 horizon. Geologic erosion on such soils as Rayford soils hinders horizon development. The sediment in which Yahola soils formed on flood plains was deposited so recently that not enough time has lapsed for the formation of horizons.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Broad-base terrace. A ridge-type terrace built to control erosion by diverting runoff along the contour at a nonscouring velocity. The terrace is 10 to 20 inches high and 15 to 30 feet wide and has gently sloping sides, a rounded crown, and a dish-shaped channel along the upper side. It may be nearly level or have a grade toward one or both ends.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Cement rock. Shaly limestone used in the manufacture of cement.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.
Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.
Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.
Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.
Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.
Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.
Coarse textured soil. Sand or loamy sand.
Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.
Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.
Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.
Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.
Compressible (in tables). Excessive decrease in volume of soft soil under load.
Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.
Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—
Loose.—Noncoherent when dry or moist; does not hold together in a mass.
Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.
Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.
Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.
Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.
Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.
Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.
Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.
Deferred grazing. Postponing grazing or resting grazingland for a prescribed period.
Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.
Depth to rock (in tables). Bedrock is too near the surface for the specified use.
Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.
Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow.

Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

Gilgai. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, alluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Arabic numeral 2 precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Open space. A relatively undeveloped green or wooded area provided mainly within an urban area to minimize feelings of congested living.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Saprolite (soil science). Unconsolidated residual material underlying the soil and grading to hard bedrock below.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium absorption ratio (SAR) of a saturation extract, or the ratio of Na^+ to Ca^{++} + Mg^{++}. The degrees of sodicity are—

	SAR
Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine.

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-77 at Pauls Valley, Oklahoma]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	51.9	27.6	39.8	77	2	21	1.29	0.25	2.09	3	2.5
February---	58.1	32.2	45.2	82	11	52	1.46	.68	2.10	4	1.8
March------	65.7	39.6	52.6	91	16	192	2.30	.97	3.37	5	1.1
April------	75.9	50.7	63.3	94	27	399	3.52	1.72	4.98	6	.0
May--------	83.1	59.3	71.2	97	40	657	5.22	2.54	7.41	7	.0
June-------	91.2	67.7	79.5	102	51	885	3.18	1.37	4.64	5	.0
July-------	96.3	71.5	83.9	107	57	1,051	2.46	.99	3.65	4	.0
August-----	96.1	70.0	83.1	107	57	1,026	2.46	.81	3.77	4	.0
September--	88.0	62.7	75.4	103	42	762	3.85	1.27	5.92	5	.0
October----	77.5	51.0	64.3	95	30	443	3.72	.96	5.92	5	.0
November---	64.0	38.9	51.4	84	17	127	2.07	.53	3.31	4	.3
December---	54.4	30.8	42.6	77	7	21	1.72	.58	2.63	3	2.2
Yearly:											
Average--	75.2	50.2	62.7	---	---	---	---	---	---	---	---
Extreme--	---	---	---	109	0	---	---	---	---	---	---
Total----	---	---	---	---	---	5,636	33.25	25.27	40.73	55	7.9

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-77 at Pauls Valley, Oklahoma]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	March 30	April 8	April 16
2 years in 10 later than--	March 24	April 3	April 12
5 years in 10 later than--	March 12	March 25	April 4
First freezing temperature in fall:			
1 year in 10 earlier than--	November 5	October 25	October 16
2 years in 10 earlier than--	November 11	October 30	October 22
5 years in 10 earlier than--	November 23	November 9	October 31

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-77 at Pauls Valley, Oklahoma]

Probability	Length of growing season if daily minimum temperature is--		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	228	210	191
8 years in 10	237	216	198
5 years in 10	255	229	209
2 years in 10	273	241	221
1 year in 10	283	247	227

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Bastrop fine sandy loam, 1 to 3 percent slopes	879	0.3
2	Bastrop fine sandy loam, 5 to 8 percent slopes	608	0.2
3	Bastrop loam, 1 to 5 percent slopes, eroded	2,241	0.8
4	Bastrop-Urban land complex, 1 to 5 percent slopes	65	*
5	Bastrop and Konawa soils, 3 to 8 percent slopes, gullied	511	0.2
6	Burleson clay, 1 to 3 percent slopes	4,167	1.5
7	Catoosa-Shidler complex, 2 to 8 percent slopes	3,204	1.2
8	Chigley gravelly sandy loam, 1 to 5 percent slopes	6,487	2.4
9	Chigley gravelly sandy loam, 5 to 12 percent slopes	5,278	1.9
10	Chigley-Naru complex, 5 to 30 percent slopes	4,821	1.8
11	Chigley-Urban land complex, 2 to 8 percent slopes	25	*
12	Chigley and Clarita soils, 2 to 6 percent slopes, gullied	6,989	2.6
13	Claremore-Rock outcrop complex, 1 to 5 percent slopes	9,166	3.3
14	Claremore-Urban land complex, 1 to 5 percent slopes	40	*
15	Clarita clay, 2 to 5 percent slopes, eroded	20,109	7.2
16	Clarita clay, 5 to 12 percent slopes, eroded	15,721	5.7
17	Clarita-Urban land complex, 2 to 12 percent slopes	515	0.2
18	Dale silt loam, rarely flooded	2,895	1.1
19	Durant loam, 0 to 1 percent slopes	2,084	0.8
20	Durant loam, 1 to 3 percent slopes	5,634	2.1
21	Durant loam, 2 to 5 percent slopes, eroded	9,216	3.3
22	Durant loam, 2 to 5 percent slopes, gullied	1,253	0.5
23	Durant-Urban land complex, 0 to 5 percent slopes	895	0.3
24	Elandco silt loam, occasionally flooded	3,959	1.5
25	Eufaula loamy fine sand, undulating	215	0.1
26	Fitzhugh loam, 1 to 3 percent slopes	1,131	0.4
27	Fitzhugh loam, 2 to 5 percent slopes, eroded	2,247	0.8
28	Fitzhugh loam, 2 to 5 percent slopes, gullied	725	0.3
29	Garvin silty clay, occasionally flooded	6,378	2.4
30	Garvin and Elandco soils, frequently flooded	13,403	4.9
31	Gasil sandy loam, 2 to 5 percent slopes, eroded	647	0.2
32	Gasil sandy loam, 2 to 5 percent slopes, gullied	287	0.1
33	Gasil fine sandy loam, 1 to 3 percent slopes	1,469	0.5
34	Gasil Variant shaly silt loam, 2 to 5 percent slopes	773	0.3
35	Grainola cobbly clay loam, 5 to 20 percent slopes, eroded	1,344	0.5
36	Kingfisher Variant-Rock outcrop complex, 2 to 6 percent slopes	2,749	1.0
37	Kiti-Rock outcrop complex, 2 to 8 percent slopes	3,918	1.4
38	Kiti-Rock outcrop complex, 8 to 20 percent slopes	61,528	22.5
39	Kiti-Scullin complex, 2 to 6 percent slopes	896	0.3
40	Konawa fine sandy loam, 0 to 2 percent slopes	1,296	0.5
41	Konsil fine sandy loam, 3 to 5 percent slopes	825	0.3
42	Lula silt loam, 1 to 3 percent slopes	4,071	1.5
43	McLain silty clay loam, rarely flooded	1,217	0.5
44	Norge Variant silt loam, 1 to 3 percent slopes	909	0.3
45	Pits, quarries	744	0.3
46	Rayford cobbly loam, 5 to 20 percent slopes	10,725	3.9
47	Rayford-Urban land complex, 5 to 20 percent slopes	100	*
48	Renfrow silt loam, 1 to 3 percent slopes	479	0.2
49	Renfrow silt loam, 3 to 5 percent slopes	314	0.1
50	Rock outcrop-Kiti complex, 20 to 45 percent slopes	10,002	3.6
51	Shidler-Clarita complex, 2 to 8 percent slopes	4,635	1.7
52	Shidler-Rock outcrop complex, 2 to 8 percent slopes	8,105	3.0
53	Stephenville Variant fine sandy loam, 3 to 5 percent slopes	527	0.2
54	Stephenville Variant-Darnell Variant complex, 5 to 20 percent slopes	398	0.1
55	Teller loam, 0 to 1 percent slopes	271	0.1
56	Teller loam, 1 to 3 percent slopes	240	0.1
57	Timhill stony silt loam, 5 to 30 percent slopes	6,000	2.2
58	Travertine-Bromide complex, 5 to 25 percent slopes	4,274	1.6
59	Tussy clay, 2 to 5 percent slopes	339	0.1
60	Tussy clay, 5 to 30 percent slopes, eroded	926	0.3
61	Watonga clay, rarely flooded	3,895	1.4
62	Watonga silty clay loam, rarely flooded	569	0.2
63	Wilson silt loam, 0 to 1 percent slopes	699	0.3
64	Yahola fine sandy loam, occasionally flooded	3,417	1.3
65	Yahola loamy fine sand, frequently flooded	901	0.3
	Water	3,570	1.3
	Total	273,920	100.0

* Less than 0.1 percent.

TABLE 5.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Map symbol and soil name	Capability subclass	Wheat	Grain sorghum	Soybeans	Peanuts	Alfalfa hay	Oats
		Bu	Bu	Bu	Lbs	Tons	Bu
1---------------- Bastrop	IIe	30	55	25	1,500	3.0	45
2---------------- Bastrop	IVe	20	40	15	1,000	---	30
3---------------- Bastrop	IIIe	20	40	15	1,200	---	30
4---------------- Bastrop-Urban land	---	---	---	---	---	---	---
5---------------- Bastrop and Konawa	VIe	---	---	---	---	---	---
6---------------- Burleson	IIe	30	55	25	---	---	45
7---------------- Catoosa-Shidler	VIe	---	---	---	---	---	---
8---------------- Chigley	IVe	20	40	15	---	---	30
9---------------- Chigley	VIe	---	---	---	---	---	---
10--------------- Chigley-Naru	VIIe	---	---	---	---	---	---
11--------------- Chigley-Urban land	---	---	---	---	---	---	---
12--------------- Chigley and Clarita	VIe	---	---	---	---	---	---
13--------------- Claremore-Rock outcrop	VIIs	---	---	---	---	---	---
14--------------- Claremore-Urban land	---	---	---	---	---	---	---
15--------------- Clarita	IIIe	20	35	15	---	---	30
16--------------- Clarita	VIe	---	---	---	---	---	---
17--------------- Clarita-Urban land	---	---	---	---	---	---	---
18--------------- Dale	I	35	70	40	1,700	5.5	60
19--------------- Durant	I	32	55	30	400	---	55

TABLE 5.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS--Continued

Map symbol and soil name	Capability subclass	Wheat	Grain sorghum	Soybeans	Peanuts	Alfalfa hay	Oats
		Bu	Bu	Bu	Lbs	Tons	Bu
20--------------- Durant	IIe	30	50	25	1,200	---	50
21--------------- Durant	IVe	25	45	20	---	---	45
22--------------- Durant	VIe	---	---	---	---	---	---
23--------------- Durant-Urban land	---	---	---	---	---	---	---
24--------------- Elandco	IIw	35	70	30	---	5.0	60
25--------------- Eufaula	VIe	---	---	---	---	---	---
26--------------- Fitzhugh	IIe	30	55	25	1,500	3.0	50
27--------------- Fitzhugh	IIIe	20	40	15	1,000	2.0	35
28--------------- Fitzhugh	VIe	---	---	---	---	---	---
29--------------- Garvin	IIIw	35	60	30	---	4.5	60
30--------------- Garvin and Elandco	Vw	---	---	---	---	---	---
31--------------- Gasil	IVe	20	40	15	1,100	---	35
32--------------- Gasil	VIe	---	---	---	---	---	---
33--------------- Gasil	IIe	30	55	25	1,500	---	50
34--------------- Gasil Variant	IIIe	20	40	15	1,100	---	35
35--------------- Grainola	VIIs	---	---	---	---	---	---
36--------------- Kingfisher Variant-Rock outcrop	VIIs	---	---	---	---	---	---
37--------------- Kiti-Rock outcrop	VIIs	---	---	---	---	---	---
38--------------- Kiti-Rock outcrop	VIIs	---	---	---	---	---	---
39--------------- Kiti-Scullin	VIIs	---	---	---	---	---	---
40--------------- Konawa	IIe	30	55	25	1,500	---	50

TABLE 5.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS--Continued

Map symbol and soil name	Capability subclass	Wheat	Grain sorghum	Soybeans	Peanuts	Alfalfa hay	Oats
		Bu	Bu	Bu	Lbs	Tons	Bu
41--------------- Konsil	IIIe	25	45	20	1,300	---	40
42--------------- Lula	IIe	30	55	25	1,500	3.0	50
43--------------- McLain	I	35	60	30	---	5.0	60
44--------------- Norge Variant	IIe	30	55	25	1,500	---	50
45*-------------- Pits	---	---	---	---	---	---	---
46--------------- Rayford	VIIs	---	---	---	---	---	---
47--------------- Rayford-Urban land	---	---	---	---	---	---	---
48--------------- Renfrow	IIIe	25	30	20	---	---	40
49--------------- Renfrow	IVe	20	25	15	---	---	30
50--------------- Rock outcrop-Kiti	VIIs	---	---	---	---	---	---
51--------------- Shidler-Clarita	VIIs	---	---	---	---	---	---
52--------------- Shidler-Rock outcrop	VIIs	---	---	---	---	---	---
53--------------- Stephenville Variant	IIIe	20	40	15	1,100	---	30
54--------------- Stephenville Variant-Darnell Variant	VIe	---	---	---	---	---	---
55--------------- Teller	I	30	60	30	1,500	3.5	50
56--------------- Teller	IIe	30	55	25	1,500	3.0	50
57--------------- Timhill	VIIs	---	---	---	---	---	---
58--------------- Travertine-Bromide	VIIe	---	---	---	---	---	---
59--------------- Tussy	IVe	15	20	10	---	---	25
60--------------- Tussy	VIIe	---	---	---	---	---	---

See footnote at end of table.

TABLE 5.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS--Continued

Map symbol and soil name	Capability subclass	Wheat	Grain sorghum	Soybeans	Peanuts	Alfalfa hay	Oats
		Bu	Bu	Bu	Lbs	Tons	Bu
61, 62----------- Watonga	IIIw	30	55	25	---	3.5	50
63--------------- Wilson	IIIw	25	50	20	---	---	40
64--------------- Yahola	IIw	30	50	30	1,600	3.5	50
65--------------- Yahola	Vw	---	---	---	---	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--GRAZING YIELDS PER ACRE OF PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Map symbol and soil name	Wheat grazeout	Forage sorghum	Rye and Ryegrass grazeout	Plains bluestem (Old World)	Improved bermuda-grass	Weeping lovegrass
	AUM*	AUM*	AUM*	AUM*	AUM*	AUM*
1---------------Bastrop	4.0	4.1	4.4	5.0	5.0	5.5
2---------------Bastrop	2.6	3.0	2.9	5.0	5.0	5.5
3---------------Bastrop	2.6	3.0	2.9	4.0	4.0	4.5
4---------------Bastrop-Urban land	---	---	---	---	---	---
5---------------Bastrop and Konawa	---	---	---	2.5	2.5	3.0
6---------------Burleson	4.0	4.1	4.2	7.0	7.0	6.5
7---------------Catoosa-Shidler	---	---	---	3.0	3.0	2.5
8---------------Chigley	2.6	---	2.9	5.0	5.0	5.5
9---------------Chigley	---	---	---	5.0	5.0	4.5
10--------------Chigley-Naru	---	---	---	5.0	5.0	4.5
11--------------Chigley-Urban land	---	---	---	---	---	---
12--------------Chigley and Clarita	---	---	---	3.5	3.0	2.5
13--------------Claremore-Rock outcrop	---	---	---	---	---	---
14--------------Claremore-Urban land	---	---	---	---	---	---
15--------------Clarita	2.6	2.6	2.9	4.5	5.0	4.5
16--------------Clarita	---	---	---	4.0	4.5	4.0
17--------------Clarita-Urban land	---	---	---	---	---	---
18--------------Dale	4.5	5.2	4.7	8.5	8.5	---
19--------------Durant	4.2	4.1	4.4	6.0	6.0	5.5

See footnotes at end of table.

TABLE 6.--GRAZING YIELDS PER ACRE OF PASTURE--Continued

Map symbol and soil name	Wheat grazeout	Forage sorghum	Rye and Ryegrass grazeout	Plains bluestem (Old World)	Improved bermuda-grass	Weeping lovegrass
	AUM*	AUM*	AUM*	AUM*	AUM*	AUM*
20------------- Durant	4.0	3.6	4.2	6.0	6.0	5.5
21------------- Durant	3.3	3.5	3.5	5.0	4.5	4.0
22------------- Durant	---	---	---	4.0	3.0	2.5
23------------- Durant-Urban land	---	---	---	---	---	---
24------------- Elandco	4.5	5.2	4.7	---	8.5	---
25------------- Eufaula	---	---	---	---	4.0	4.5
26------------- Fitzhugh	4.0	4.1	4.2	6.0	6.0	5.5
27------------- Fitzhugh	2.6	3.0	2.7	4.5	4.5	4.0
28------------- Fitzhugh	---	---	---	3.0	3.0	2.5
29------------- Garvin	4.6	4.5	4.8	---	6.0	---
30------------- Garvin and Elandco	---	---	---	---	6.5	---
31------------- Gasil	2.6	3.0	2.7	4.0	4.0	4.5
32------------- Gasil	---	---	---	2.5	2.5	3.0
33------------- Gasil	4.0	3.7	4.4	5.0	5.0	5.5
34------------- Gasil Variant	2.6	3.0	2.8	---	4.5	5.0
35------------- Grainola	---	---	---	---	---	---
36------------- Kingfisher Variant-Rock outcrop	---	---	---	---	---	---
37------------- Kiti-Rock outcrop	---	---	---	---	---	---
38------------- Kiti-Rock outcrop	---	---	---	---	---	---
39------------- Kiti-Scullin	---	---	---	---	---	---
40------------- Konawa	4.0	4.1	4.4	5.0	5.0	5.5

See footnotes at end of table.

TABLE 6.--GRAZING YIELDS PER ACRE OF PASTURE--Continued

Map symbol and soil name	Wheat grazeout	Forage sorghum	Rye and Ryegrass grazeout	Plains bluestem (Old World)	Improved bermuda-grass	Weeping lovegrass
	AUM*	AUM*	AUM*	AUM*	AUM*	AUM*
41-------------- Konsil	3.2	3.4	3.5	5.0	5.0	5.5
42-------------- Lula	4.0	4.1	4.2	6.0	6.0	5.5
43-------------- McLain	4.5	4.5	4.7	---	6.0	---
44-------------- Norge Variant	4.0	4.1	4.2	5.5	5.5	5.0
45*------------- Pits	---	---	---	---	---	---
46-------------- Rayford	---	---	---	---	---	---
47-------------- Rayford-Urban land	---	---	---	---	---	---
48-------------- Renfrow	3.3	2.3	3.4	5.0	4.0	3.5
49-------------- Renfrow	2.6	1.9	2.7	5.0	4.0	3.5
50-------------- Rock outcrop-Kiti	---	---	---	---	---	---
51-------------- Shidler-Clarita	---	---	---	---	---	---
52-------------- Shidler-Rock outcrop	---	---	---	---	---	---
53-------------- Stephenville Variant	2.6	3.0	2.8	---	4.5	5.0
54-------------- Stephenville Variant-Darnell Variant	---	---	---	---	3.5	4.0
55-------------- Teller	4.0	4.5	4.4	6.0	6.0	5.5
56-------------- Teller	4.0	4.1	4.4	6.0	6.0	5.5
57-------------- Timhill	---	---	---	---	---	---
58-------------- Travertine-Bromide	---	---	---	---	2.5	2.0
59-------------- Tussy	2.0	1.5	2.1	3.0	2.5	2.0
60-------------- Tussy	---	---	---	2.5	2.0	1.5

See footnotes at end of table.

TABLE 6.--GRAZING YIELDS PER ACRE OF PASTURE--Continued

Map symbol and soil name	Wheat grazeout	Forage sorghum	Rye and Ryegrass grazeout	Plains bluestem (Old World)	Improved bermuda-grass	Weeping lovegrass
	AUM*	AUM*	AUM*	AUM*	AUM*	AUM*
61, 62---------- Watonga	4.0	4.1	4.2	---	5.5	5.0
63-------------- Wilson	3.3	3.7	3.4	---	5.0	4.5
64-------------- Yahola	4.0	3.7	4.4	---	7.0	7.5
65-------------- Yahola	---	---	---	---	6.0	7.5

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--RANGELAND PRODUCTIVITY

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Map symbol and soil name	Range site	Potential annual production for kind of growing season		
		Favorable	Normal	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
1, 2, 3 Bastrop	Sandy Savannah	5,000	3,800	3,000
5*:				
Bastrop	Eroded Sandy Savannah	2,500	1,700	1,250
Konawa	Eroded Sandy Savannah	2,500	1,700	1,250
6 Burleson	Blackclay Prairie	7,000	4,900	3,500
7*:				
Catoosa	Loamy Prairie	5,000	3,500	2,500
Shidler	Very Shallow	2,500	1,300	500
8, 9 Chigley	Sandy Savannah	5,000	3,500	2,500
10*:				
Chigley	Sandy Savannah	5,000	3,500	2,500
Naru	Sandy Savannah	5,000	3,500	2,500
12*:				
Chigley	Eroded Sandy Savannah	2,500	1,750	1,250
Clarita	Eroded Prairie	3,200	2,350	1,750
13*:				
Claremore	Loamy Prairie	4,500	3,300	2,500
Rock outcrop.				
15, 16 Clarita	Blackclay Prairie	6,500	4,700	3,500
18 Dale	Loamy Bottomland	8,500	6,100	4,500
19, 20, 21 Durant	Loamy Prairie	6,000	4,200	3,000
22 Durant	Eroded Prairie	3,000	2,100	1,500
24 Elandco	Loamy Bottomland	8,500	6,100	4,500
25 Eufaula	Deep Sand Savannah	4,000	2,800	2,000
26, 27 Fitzhugh	Loamy Prairie	6,000	4,200	3,000
28 Fitzhugh	Eroded Prairie	3,000	2,100	1,500
29 Garvin	Heavy Bottomland	6,000	3,900	2,500

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY--Continued

Map symbol and soil name	Range site	Potential annual production for kind of growing season		
		Favorable Lb/acre	Normal Lb/acre	Unfavorable Lb/acre
30*:				
Garvin	Heavy Bottomland	6,000	3,900	2,500
Elandco	Loamy Bottomland	8,500	6,100	4,500
31 Gasil	Sandy Savannah	4,500	3,300	2,500
32 Gasil	Eroded Sandy Savannah	2,500	1,700	1,250
33 Gasil	Sandy Savannah	5,000	3,800	3,000
34 Gasil Variant	Sandy Savannah	4,500	3,300	2,500
35 Grainola	Shallow Prairie	3,200	2,200	1,500
36*:				
Kingfisher Variant	Loamy Prairie	5,200	4,000	3,200
Rock outcrop.				
37*, 38*:				
Kiti	Edgerock	2,800	2,000	1,400
Rock outcrop.				
39*:				
Kiti	Edgerock	2,800	2,000	1,400
Scullin	Loamy Prairie	5,000	4,200	3,000
40 Konawa	Sandy Savannah	5,000	3,800	3,000
41 Konsil	Sandy Savannah	5,000	3,800	3,000
42 Lula	Loamy Prairie	6,000	4,200	3,000
43 McLain	Heavy Bottomland	6,000	4,200	3,000
44 Norge Variant	Loamy Prairie	5,500	4,000	2,500
46 Rayford	Shallow Prairie	2,500	1,700	1,200
48, 49 Renfrow	Claypan Prairie	4,000	2,800	2,000
50*:				
Rock outcrop.				
Kiti	Breaks	2,200	1,500	1,100
51*:				
Shidler	Very Shallow	2,500	1,300	500
Clarita	Blackclay Prairie	6,500	4,700	3,500
52*:				
Shidler	Very Shallow	2,500	1,300	500

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY--Continued

Map symbol and soil name	Range site	Potential annual production for kind of growing season		
		Favorable	Normal	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
52*: Rock outcrop.				
53 Stephenville Variant	Sandy Savannah	4,500	3,300	2,500
54*: Stephenville Variant	Sandy Savannah	4,500	3,300	2,500
Darnell Variant	Shallow Savannah	3,000	1,900	1,200
55, 56 Teller	Loamy Prairie	6,000	4,200	3,000
57 Timhill	Granite Hills	1,800	1,000	500
58*: Travertine	Shallow Savannah	2,200	1,400	900
Bromide	Sandy Savannah	3,000	2,200	1,600
59 Tussy	Red Clay Prairie	2,500	1,600	1,000
60 Tussy	Red Clay Prairie	1,900	1,200	750
61, 62 Watonga	Heavy Bottomland	5,500	3,700	2,500
63 Wilson	Claypan Prairie	4,000	2,800	2,000
64 Yahola	Loamy Bottomland	7,000	4,900	3,500
65 Yahola	Sandy Bottomland	3,800	2,700	2,000

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Map symbol and soil name	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
1, 2, 3----------- Bastrop	Skunkbush sumac---	American plum, lilac.	Redbud, eastern redcedar, Austrian pine.	Osageorange, hackberry.	Chinese elm, eastern cottonwood, honeylocust, American sycamore.
4*:					
Bastrop----------	Skunkbush sumac---	American plum, lilac.	Redbud, eastern redcedar, Austrian pine.	Osageorange, hackberry.	Chinese elm, eastern cottonwood, honeylocust, American sycamore.
Urban land.					
5*:					
Bastrop----------	Skunkbush sumac---	American plum, lilac.	Redbud, eastern redcedar, Austrian pine.	Osageorange, hackberry.	Chinese elm, eastern cottonwood, honeylocust, American sycamore.
Konawa-----------	Skunkbush sumac---	American plum, lilac, Amur honeysuckle.	Ponderosa pine, Austrian pine, eastern redcedar, Scotch pine.	Chinese elm, red mulberry, honeylocust, black locust.	---
6----------------- Burleson	Lilac, skunkbush sumac.	Amur honeysuckle, Austrian pine.	Eastern redcedar, Chinese elm, common hackberry.	---	---
7*:					
Catoosa----------	Skunkbush sumac, lilac, Amur honeysuckle.	Redbud, Rocky Mountain juniper, oriental arborvitae.	Eastern redcedar, osageorange, Arizona cypress.	---	---
Shidler----------	Lilac, Amur honeysuckle, skunkbush sumac.	Redbud, eastern redcedar, osageorange.	---	---	---
8, 9-------------- Chigley	Lilac, skunkbush sumac.	Austrian pine, ponderosa pine, Amur honeysuckle, redbud.	Hackberry, osageorange, Chinese elm, honeylocust, eastern redcedar, silver maple.	---	---
10*:					
Chigley----------	Lilac, skunkbush sumac.	Austrian pine, redbud, ponderosa pine, Amur honeysuckle.	Hackberry, osageorange, Chinese elm, honeylocust, eastern redcedar, silver maple.	---	---
Naru-------------	Lilac------------	American plum-----	Austrian pine, eastern redcedar, oriental arborvitae, Scotch pine, green ash, ponderosa pine, common hackberry.	---	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Map symbol and soil name	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
11*:					
Chigley	Lilac, skunkbush sumac.	Austrian pine, ponderosa pine, Amur honeysuckle, redbud.	Hackberry, osageorange, Chinese elm, honeylocust, eastern redcedar, silver maple.	---	---
Urban land.					
12*:					
Chigley	Lilac, skunkbush sumac.	Austrian pine, ponderosa pine, Amur honeysuckle, redbud.	Hackberry, osageorange, Chinese elm, honeylocust, eastern redcedar, silver maple.	---	---
Clarita	Skunkbush sumac, lilac.	Amur honeysuckle, redbud, ponderosa pine, Austrian pine.	Eastern redcedar, hackberry, honeylocust, osageorange, Chinese elm, silver maple.	---	---
13*:					
Claremore	Amur honeysuckle, lilac, skunkbush sumac.	Rocky Mountain juniper, redbud.	Eastern redcedar, Arizona cypress, oriental arborvitae, osageorange.	---	---
Rock outcrop.					
14*:					
Claremore	Amur honeysuckle, lilac, skunkbush sumac.	Rocky Mountain juniper, redbud.	Eastern redcedar, Arizona cypress, oriental arborvitae, osageorange.	---	---
Urban land.					
15, 16 Clarita	Skunkbush sumac, lilac.	Amur honeysuckle, redbud, ponderosa pine, Austrian pine.	Eastern redcedar, hackberry, honeylocust, osageorange, Chinese elm, silver maple.	---	---
17*:					
Clarita	Skunkbush sumac, lilac.	Amur honeysuckle, redbud, ponderosa pine, Austrian pine.	Eastern redcedar, hackberry, honeylocust, osageorange, Chinese elm, silver maple.	---	---
Urban land.					
18 Dale	Skunkbush sumac	American plum, Amur honeysuckle, lilac.	Austrian pine, eastern redcedar, oriental arborvitae, ponderosa pine, Arizona cypress, redbud.	Common hackberry, autumn-olive, bur oak, green ash, red mulberry, Russian-olive.	American sycamore, Chinese elm, black locust, eastern cottonwood, silver maple, honeylocust.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Map symbol and soil name	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
19, 20, 21, 22---- Durant	Skunkbush sumac, lilac.	Ponderosa pine, Amur honeysuckle, Austrian pine, redbud.	Honeylocust, silver maple, osageorange, Chinese elm, eastern redcedar, hackberry.	---	---
23*: Durant-----------	Skunkbush sumac, lilac.	Ponderosa pine, Amur honeysuckle, Austrian pine, redbud.	Honeylocust, silver maple, osageorange, Chinese elm, eastern redcedar, hackberry.	---	---
Urban land.					
24---------------- Elandco	Skunkbush sumac---	Lilac, American plum, Amur honeysuckle.	Eastern redcedar, Austrian pine, Arizona cypress, redbud, ponderosa pine, Scotch pine.	Osageorange, bur oak, red mulberry, autumn-olive green ash, Russian-olive.	Chinese elm, eastern cottonwood, American sycamore, black locust, silver maple, honeylocust.
25---------------- Eufaula	Skunkbush sumac, lilac.	Redbud, Amur honeysuckle, Austrian pine, ponderosa pine.	Eastern redcedar, Chinese elm, red mulberry, honeylocust, osageorange, silver maple.	---	---
26, 27, 28-------- Fitzhugh	Skunkbush sumac---	Lilac, American plum, Amur honeysuckle.	Eastern redcedar, Austrian pine, eastern redcedar, ponderosa pine.	Chinese elm, osageorange, honeylocust, silver maple.	---
29---------------- Garvin	Skunkbush sumac---	Amur honeysuckle, lilac.	Austrian pine, American plum, redbud, eastern redcedar, Scotch pine.	Osageorange-------	Eastern cottonwood, American sycamore, honeylocust.
30*: Garvin-----------	Skunkbush sumac---	Amur honeysuckle, lilac.	Austrian pine, American plum, redbud, eastern redcedar, Scotch pine.	Osageorange-------	Eastern cottonwood, American sycamore, honeylocust.
Elandco----------	Skunkbush sumac---	Lilac, American plum, Amur honeysuckle.	Eastern redcedar, Austrian pine.	Osageorange, red mulberry.	Chinese elm, eastern cottonwood, American sycamore, black locust.
31, 32, 33-------- Gasil	Lilac, skunkbush sumac.	American plum, Amur honeysuckle.	Austrian pine, eastern redcedar, Scotch pine, Chinese elm.	---	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Map symbol and soil name	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
34----------------- Gasil Variant	Lilac, skunkbush sumac.	American plum, Amur honeysuckle.	Austrian pine, eastern redcedar, Scotch pine, Chinese elm.	---	---
35----------------- Grainola	Lilac, skunkbush sumac.	Amur honeysuckle, Austrian pine, ponderosa pine, redbud.	Eastern redcedar, bur oak, honeylocust, osageorange, common hackberry.	---	---
36*:					
Kingfisher Variant----------	Skunkbush sumac---	Lilac, American plum, Amur honeysuckle.	Eastern redcedar, Austrian pine, ponderosa pine, redbud, Scotch pine.	Black locust, bur oak, Chinese elm, common hackberry, green ash, osageorange, silver maple.	---
Rock outcrop.					
37*, 38*:					
Kiti--------------	Lilac, skunkbush sumac, Amur honeysuckle.	Redbud, eastern redcedar, oriental arborvitae, Rocky Mountain juniper, osageorange.	---	---	---
Rock outcrop.					
39*:					
Kiti--------------	Lilac, skunkbush sumac, Amur honeysuckle.	Redbud, eastern redcedar, oriental arborvitae, Rocky Mountain juniper, osageorange.	---	---	---
Scullin-----------	Lilac, skunkbush sumac.	Amur honeysuckle, Austrian pine, ponderosa pine, euonymus, redbud.	Eastern redcedar, oriental arborvitae, bur oak, common hackberry, osageorange, honeylocust.	---	---
40----------------- Konawa	Skunkbush sumac---	American plum, lilac, Amur honeysuckle.	Ponderosa pine, Austrian pine, eastern redcedar, Scotch pine.	Chinese elm, red mulberry, honeylocust, black locust.	---
41----------------- Konsil	Lilac, skunkbush sumac.	American plum, Amur honeysuckle.	Austrian pine, eastern redcedar, Scotch pine, Chinese elm.	---	---
42----------------- Lula	American plum, skunkbush sumac.	Amur honeysuckle, American plum, lilac.	Austrian pine, redbud.	Chinese elm, honeylocust, black locust, osageorange.	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Map symbol and soil name	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
43----------------- McLain	Skunkbush sumac---	Lilac, Amur honeysuckle.	Eastern redcedar, Austrian pine, redbud, green ash.	Osageorange, Chinese elm, honeylocust.	American sycamore, eastern cottonwood.
44----------------- Norge Variant	Skunkbush sumac---	American plum, Amur honeysuckle, lilac.	Redbud, Austrian pine, eastern redcedar.	Osageorange, hackberry, bur oak.	Black locust, Chinese elm.
45*. Pits					
46----------------- Rayford	Amur honeysuckle, lilac, skunkbush sumac.	Rocky Mountain juniper, redbud, eastern redcedar.	---	---	---
47*:					
Rayford-----------	Amur honeysuckle, lilac, skunkbush sumac.	Rocky Mountain juniper, redbud, eastern redcedar.	---	---	---
Urban land.					
48, 49------------ Renfrow	Lilac, skunkbush sumac.	Amur honeysuckle, Austrian pine, redbud, Rocky Mountain juniper.	Eastern redcedar, bur oak, Chinese elm, common hackberry.	---	---
50*:					
Rock outcrop.					
Kiti--------------	Lilac, skunkbush sumac, Amur honeysuckle.	Redbud, eastern redcedar, oriental arborvitae, Rocky Mountain juniper, osageorange.	---	---	---
51*:					
Shidler-----------	Lilac, skunkbush sumac, Amur honeysuckle.	Redbud, eastern redcedar, oriental arborvitae, Rocky Mountain, juniper, osageorange.	---	---	---
Clarita-----------	Skunkbush sumac, lilac.	Amur honeysuckle, redbud, ponderosa pine, Austrian pine.	Eastern redcedar, hackberry, honeylocust, osageorange, Chinese elm, silver maple.	---	---
52*:					
Shidler-----------	Lilac, skunkbush sumac, Amur honeysuckle.	Redbud, eastern redcedar, oriental arborvitae, Rocky Mountain juniper, osageorange.	---	---	---
Rock outcrop.					

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Map symbol and soil name	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
53. Stephenville Variant	Amur honeysuckle, lilac, skunkbush sumac.	Redbud, oriental arborvitae, Rocky Mountain juniper.	Eastern redcedar, Arizona cypress, osageorange.	---	---
54*:					
Stephenville Variant	Amur honeysuckle, lilac, skunkbush sumac.	Redbud, oriental arborvitae, Rocky Mountain juniper.	Eastern redcedar, Arizona cypress, osageorange.	---	---
Darnell Variant	Lilac, skunkbush sumac, Amur honeysuckle.	Redbud, eastern redcedar, osageorange, Rocky Mountain juniper.	---	---	---
55, 56. Teller	Skunkbush sumac	American plum, lilac.	Redbud, eastern redcedar, Austrian pine.	Osageorange, hackberry.	Chinese elm, eastern cottonwood, honeylocust, American sycamore.
57. Timhill	Lilac, skunkbush sumac, Amur honeysuckle.	Redbud, eastern redcedar, oriental arborvitae, Rocky Mountain juniper, osageorange.	---	---	---
58*:					
Travertine	Lilac, skunkbush sumac, Amur honeysuckle.	Redbud, eastern redcedar, oriental arborvitae, Rocky Mountain juniper, osageorange.	---	---	---
Bromide	Lilac, Amur honeysuckle, skunkbush sumac.	American plum, redbud, Rocky Mountain juniper.	Eastern redcedar, osageorange, black locust, oriental arborvitae.	---	---
59. Tussy	Lilac, skunkbush sumac.	Austrian pine, Amur honeysuckle, redbud.	Eastern redcedar, honeylocust, hackberry, osageorange, Chinese elm, red mulberry, silver maple.	---	---
60. Tussy	Lilac, skunkbush sumac.	Austrian pine, Amur honeysuckle, redbud.	Eastern redcedar, honeylocust, hackberry, osageorange, Chinese elm, red mulberry, silver maple.	---	---
61, 62. Watonga	Skunkbush sumac	Amur honeysuckle, lilac.	Autumn-olive, eastern redcedar, Austrian pine, redbud.	Chinese elm, honeylocust, osageorange.	American sycamore, eastern cottonwood.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Map symbol and soil name	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
63----------------- Wilson	Lilac, skunkbush sumac.	Amur honeysuckle, Austrian pine, ponderosa pine, redbud.	Eastern redcedar, oriental arborvitae, bur oak, Chinese elm, common hackberry, silver maple.	---	---
64, 65------------ Yahola	Skunkbush sumac---	American plum, lilac.	Austrian pine, eastern redcedar, ponderosa pine, Scotch pine.	Red mulberry, osageorange.	Eastern cottonwood, Chinese elm, American sycamore.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1 Bastrop	Slight	Slight	Moderate: slope.	Slight	Slight.
2 Bastrop	Slight	Slight	Severe: slope.	Slight	Slight.
3 Bastrop	Slight	Slight	Moderate: slope.	Slight	Slight.
4*:					
Bastrop	Slight	Slight	Moderate: slope.	Slight	Slight.
Urban land.					
5*:					
Bastrop	Slight	Slight	Severe: slope.	Slight	Slight.
Konawa	Slight	Slight	Severe: slope.	Slight	Moderate: droughty.
6 Burleson	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, small stones, too clayey.	Moderate: too clayey.	Severe: too clayey.
7*:					
Catoosa	Slight	Slight	Severe: slope.	Severe: erodes easily.	Moderate: thin layer.
Shidler	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.		Severe: thin layer.
8 Chigley	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones.
9 Chigley	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Moderate: small stones, slope.
10*:					
Chigley	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Naru	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: slope, large stones.
11*:					
Chigley	Moderate: small stones.	Moderate: small stones.	Severe: slope, small stones.	Slight	Moderate: small stones.
Urban land.					

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
12*:					
Chigley	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones.
Clarita	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey.	Severe: erodes easily.	Severe: too clayey.
13*:					
Claremore	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: erodes easily.	Severe: thin layer.
Rock outcrop.					
14*:					
Claremore	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: erodes easily.	Severe: thin layer.
Urban land.					
15 Clarita	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey.	Severe: erodes easily.	Severe: too clayey.
16 Clarita	Moderate: percs slowly, slope, too clayey.	Moderate: percs slowly, slope, too clayey.	Severe: slope.	Severe: erodes easily.	Severe: too clayey.
17*:					
Clarita	Moderate: percs slowly, slope, too clayey.	Moderate: percs slowly, slope, too clayey.	Severe: slope.	Severe: erodes easily.	Severe: too clayey.
Urban land.					
18 Dale	Severe: flooding.	Slight	Slight	Severe: erodes easily.	Slight.
19 Durant	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Severe: erodes easily.	Slight.
20, 21, 22 Durant	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
23*:					
Durant	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
Urban land.					
24 Elandco	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
25 Eufaula	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
26, 27, 28 Fitzhugh	Slight	Slight	Moderate: slope.	Severe: erodes easily.	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
29------------------- Garvin	Severe: flooding.	Moderate: too clayey, percs slowly.	Severe: too clayey.	Severe: erodes easily.	Severe: too clayey.
30*:					
Garvin--------------	Severe: flooding.	Moderate: flooding, too clayey, percs slowly.	Severe: flooding, too clayey.	Severe: erodes easily.	Severe: too clayey, flooding.
Elandco-------------	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Slight----------	Severe: flooding.
31, 32, 33----------- Gasil	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
34------------------- Gasil Variant	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Moderate: large stones.
35------------------- Grainola	Severe: large stones, small stones, slope.	Severe: large stones, small stones, slope.	Severe: large stones, small stones, slope.	Severe: large stones, erodes easily.	Severe: small stones, large stones, slope.
36*:					
Kingfisher Variant---	Slight----------	Slight----------	Moderate: depth to rock, slope.	Severe: erodes easily.	Moderate: thin layer.
Rock outcrop.					
37*:					
Kiti----------------	Severe: large stones, depth to rock.	Severe: large stones, depth to rock.	Severe: large stones, slope, depth to rock.	Severe: large stones.	Severe: large stones, thin layer.
Rock outcrop.					
38*:					
Kiti----------------	Severe: slope, large stones, depth to rock.	Severe: slope, large stones, depth to rock.	Severe: large stones, slope, depth to rock.	Severe: large stones.	Severe: large stones, slope, thin layer.
Rock outcrop.					
39*:					
Kiti----------------	Severe: large stones, depth to rock.	Severe: large stones, depth to rock.	Severe: large stones, depth to rock.	Severe: large stones.	Severe: large stones, thin layer.
Scullin-------------	Slight----------	Slight----------	Moderate: small stones, slope.	Slight----------	Moderate: thin layer.
40------------------- Konawa	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
41------------------- Konsil	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
42------------------- Lula	Slight----------	Slight----------	Moderate: slope.	Severe: erodes easily.	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
43-------------------- McLain	Severe: flooding.	Slight----------	Slight----------	Severe: erodes easily.	Slight.
44-------------------- Norge Variant	Slight----------	Slight----------	Moderate: slope.	Severe: erodes easily.	Slight.
45*. Pits					
46-------------------- Rayford	Severe: large stones, slope, depth to rock.	Severe: large stones, slope, depth to rock.	Severe: large stones, slope, depth to rock.	Moderate: large stones, slope.	Severe: large stones, slope, thin layer.
47*: Rayford--------------	Severe: large stones, slope, depth to rock.	Severe: large stones, slope, depth to rock.	Severe: large stones, slope, depth to rock.	Moderate: large stones, slope.	Severe: large stones, slope, thin layer.
Urban land.					
48, 49---------------- Renfrow	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
50*: Rock outcrop.					
Kiti-----------------	Severe: slope, large stones, depth to rock.	Severe: slope, large stones, depth to rock.	Severe: large stones, slope, depth to rock.	Severe: large stones, slope.	Severe: large stones, slope, thin layer.
51*: Shidler--------------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight----------	Severe: thin layer.
Clarita--------------	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: slope.	Severe: erodes easily.	Severe: too clayey.
52*: Shidler--------------	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight----------	Severe: thin layer.
Rock outcrop.					
53-------------------- Stephenville Variant	Slight----------	Slight----------	Moderate: slope, depth to rock.	Slight----------	Moderate: depth to rock.
54*: Stephenville Variant-	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Darnell Variant------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight----------	Severe: thin layer.
55-------------------- Teller	Slight----------	Slight----------	Slight----------	Severe: erodes easily.	Slight.
56-------------------- Teller	Slight----------	Slight----------	Moderate: slope.	Severe: erodes easily.	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
57 Timhill	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, small stones, slope.	Severe: slope.	Severe: large stones, slope, thin layer.
58*:					
Travertine	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, slope.	Slight	Severe: thin layer.
Bromide	Severe: slope.	Severe: slope.	Severe: small stones, slope.	Moderate: large stones, slope.	Severe: slope.
59 Tussy	Moderate: small stones, percs slowly.	Moderate: small stones, percs slowly.	Severe: small stones, too clayey.	Severe: erodes easily.	Severe: too clayey.
60 Tussy	Severe: slope.	Severe: slope.	Severe: small stones, too clayey, slope.	Severe: erodes easily.	Severe: too clayey, slope.
61 Watonga	Severe: flooding.	Moderate: too clayey, percs slowly.	Severe: too clayey.	Severe: erodes easily.	Severe: too clayey.
62 Watonga	Severe: flooding.	Moderate: percs slowly.	Moderate: percs slowly.	Severe: erodes easily.	Slight.
63 Wilson	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, erodes easily.	Severe: wetness.
64 Yahola	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
65 Yahola	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
1------------------ Bastrop	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
2, 3--------------- Bastrop	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
4*:									
Bastrop-----------	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
Urban land.									
5*:									
Bastrop-----------	Poor	Fair	Good	Good	Poor	Very poor	Fair	Very poor	Good.
Konawa------------	Fair	Fair	Good	Good	Poor	Very poor	Fair	Very poor	Good.
6------------------ Burleson	Good	Good	Poor	Poor	Very poor	Very poor	Fair	Very poor	Poor.
7*:									
Catoosa-----------	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
Shidler-----------	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
8------------------ Chigley	Good	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
9------------------ Chigley	Fair	Good	Good	Fair	Very poor	Very poor	Good	Very poor	Fair.
10*:									
Chigley-----------	Fair	Good	Good	Fair	Very poor	Very poor	Good	Very poor	Fair.
Naru--------------	Very poor	Fair	Good	Fair	Very poor	Very poor	Poor	Very poor	Fair.
11*:									
Chigley-----------	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
Urban land.									
12*:									
Chigley-----------	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
Clarita-----------	Fair	Fair	Poor	Poor	Poor	Very poor	Fair	Very poor	Poor.
13*:									
Claremore---------	Poor	Poor	Fair	Fair	Poor	Very poor	Poor	Very poor	Good.
Rock outcrop.									
14*:									
Claremore---------	Poor	Poor	Fair	Fair	Poor	Very poor	Poor	Very poor	Fair.
Urban land.									
15, 16------------- Clarita	Fair	Fair	Poor	Poor	Poor	Very poor	Fair	Very poor	Poor.
17*:									
Clarita-----------	Fair	Fair	Poor	Poor	Poor	Very poor	Fair	Very poor	Poor.
Urban land.									

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Wetland wildlife	Rangeland wildlife
18----------------- Dale	Good	Good	Fair	Good	Poor	Very poor	Good	Very poor	Fair.
19, 20------------- Durant	Good	Good	Good	Fair	Poor	Poor	Good	Poor	Fair.
21, 22------------- Durant	Good	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
23*:									
Durant-------------	Good	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
Urban land.									
24----------------- Elandco	Good	Good	Fair	Good	Poor	Very poor	Good	Very poor	Fair.
25----------------- Eufaula	Poor	Fair	Fair	Good	Very poor	Very poor	Fair	Very poor	Fair.
26, 27, 28--------- Fitzhugh	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
29----------------- Garvin	Fair	Fair	Poor	Poor	Poor	Poor	Fair	Poor	Poor.
30*:									
Garvin-------------	Poor	Fair	Poor	Poor	Poor	Poor	Poor	Poor	Poor.
Elandco------------	Very poor	Poor	Fair	Good	Poor	Very poor	Poor	Very poor	Fair.
31, 32, 33--------- Gasil	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
34----------------- Gasil Variant	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
35----------------- Grainola	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
36*:									
Kingfisher Variant	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
Rock outcrop.									
37*, 38*:									
Kiti---------------	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Poor	Very poor	Very poor.
Rock outcrop.									
39*:									
Kiti---------------	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Poor	Very poor	Very poor.
Scullin------------	Fair	Good	Good	Poor	Poor	Very poor	Fair	Very poor	Fair.
40----------------- Konawa	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
41----------------- Konsil	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
42----------------- Lula	Good	Good	Good	Fair	Poor	Very poor	Good	Very poor	Good.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
43------------------ McLain	Good	Good	Fair	Good	Poor	Poor	Good	Poor	Fair.
44------------------ Norge Variant	Good	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
45*. Pits									
46------------------ Rayford	Very poor	Poor	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
47*:									
Rayford------------	Very poor	Poor	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
Urban land.									
48, 49------------- Renfrow	Good	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
50*: Rock outcrop.									
Kiti----------------	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Poor	Very poor	Very poor.
51*:									
Shidler------------	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Clarita------------	Fair	Fair	Poor	Poor	Poor	Very poor	Fair	Very poor	Poor.
52*:									
Shidler------------	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Rock outcrop.									
53------------------ Stephenville Variant	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
54*:									
Stephenville Variant-----------	Poor	Fair	Good	Good	Very poor	Very poor	Fair	Very poor	Good.
Darnell Variant---	Very poor	Poor	Poor	Fair	Very poor	Very poor	Poor	Very poor	Poor.
55, 56------------- Teller	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
57------------------ Timhill	Very poor	Poor	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
58*:									
Travertine---------	Poor	Poor	Fair	Poor	Very poor	Very poor	Poor	Very poor	Poor.
Bromide------------	Poor	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Fair.
59------------------ Tussy	Fair	Fair	Poor	Poor	Very poor	Very poor	Fair	Very poor	Poor.
60------------------ Tussy	Very poor	Fair	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
61, 62------------- Watonga	Fair	Fair	Poor	Fair	Poor	Poor	Fair	Poor	Fair.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
63----------------- Wilson	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair	Fair.
64----------------- Yahola	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
65----------------- Yahola	Poor	Fair	Fair	Good	Poor	Very poor	Fair	Very poor	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1 Bastrop	Slight	Slight	Slight	Slight	Moderate: low strength.	Slight.
2, 3 Bastrop	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.	Slight.
4*:						
Bastrop	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.	Slight.
Urban land.						
5*:						
Bastrop	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.	Slight.
Konawa	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
6 Burleson	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
7*:						
Catoosa	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Moderate: shrink-swell, depth to rock.	Moderate: thin layer.
Shidler	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: thin layer.
8 Chigley	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell.	Moderate: small stones.
9 Chigley	Moderate: too clayey, wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Moderate: slope, shrink-swell.	Moderate: small stones, slope.
10*:						
Chigley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Naru	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, large stones.
11*:						
Chigley	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell.	Moderate: small stones.
Urban land.						
12*:						
Chigley	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell.	Moderate: small stones.
Clarita	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: too clayey.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
13*:						
Claremore--------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: thin layer.
Rock outcrop.						
14*:						
Claremore--------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: thin layer.
Urban land.						
15, 16------------ Clarita	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: too clayey.
17*:						
Clarita----------	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: too clayey.
Urban land.						
18--------------- Dale	Slight---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: shrink-swell, flooding.	Slight.
19, 20, 21, 22---- Durant	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Slight.
23*:						
Durant-----------	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Slight.
Urban land.						
24--------------- Elandco	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
25--------------- Eufaula	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: droughty.
26--------------- Fitzhugh	Slight---------	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
27, 28------------ Fitzhugh	Slight---------	Slight---------	Slight---------	Moderate: slope.	Slight---------	Slight.
29--------------- Garvin	Moderate: too clayey, flooding.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: too clayey.
30*:						
Garvin-----------	Moderate: too clayey, flooding.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: too clayey, flooding.
Elandco----------	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: flooding.
31, 32------------ Gasil	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell.	Slight.
33--------------- Gasil	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
34----------------- Gasil Variant	Moderate: large stones.	Moderate: large stones, shrink-swell.	Moderate: large stones, shrink-swell.	Moderate: large stones, slope, shrink-swell.	Moderate: large stones, shrink-swell.	Moderate: large stones.
35----------------- Grainola	Severe: slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: small stones, large stones, slope.
36*:						
Kingfisher Variant---------	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Moderate: depth to rock, shrink-swell.	Moderate: thin layer.
Rock outcrop.						
37*:						
Kiti--------------	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: large stones, thin layer.
Rock outcrop.						
38*:						
Kiti--------------	Severe: depth to rock, large stones, slope.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: large stones, slope, thin layer.
Rock outcrop.						
39*:						
Kiti--------------	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: large stones, thin layer.
Scullin-----------	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Moderate: thin layer.
40----------------- Konawa	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
41----------------- Konsil	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: low strength, shrink-swell.	Slight.
42----------------- Lula	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: shrink-swell, depth to rock.	Moderate: shrink-swell.	Moderate: shrink-swell.	Slight.
43----------------- McLain	Moderate: too clayey.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell.	Slight.
44----------------- Norge Variant	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Slight.
45*. Pits						
46----------------- Rayford	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: large stones, slope, thin layer.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
47*:						
Rayford----------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: large stones, slope, thin layer.
Urban land.						
48, 49------------ Renfrow	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Slight.
50*: Rock outcrop.						
Kiti-------------	Severe: depth to rock, large stones, slope.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: large stones, slope, thin layer.
51*:						
Shidler----------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: thin layer.
Clarita----------	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: too clayey.
52*:						
Shidler----------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: thin layer.
Rock outcrop.						
53---------------- Stephenville Variant	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock, slope.	Moderate: depth to rock.	Moderate: depth to rock.
54*:						
Stephenville Variant---------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
Darnell Variant--	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: thin layer.
55, 56------------ Teller	Slight---------	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
57---------------- Timhill	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: large stones, slope, thin layer.
58*:						
Travertine-------	Moderate: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock, slope.	Moderate: depth to rock.	Severe: thin layer.
Bromide----------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
59---------------- Tussy	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: too clayey.
60---------------- Tussy	Severe: slope.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: too clayey, slope.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Map symbpl and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
61----------------- Watonga	Severe: cutbanks cave.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell.	Severe: too clayey.
62----------------- Watonga	Severe: cutbanks cave.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell.	Slight.
63----------------- Wilson	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
64----------------- Yahola	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
65----------------- Yahola	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1, 2, 3 Bastrop	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
4*:					
Bastrop	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
Urban land.					
5*:					
Bastrop	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
Konawa	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Slight	Good.
6 Burleson	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
7*:					
Catoosa	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, thin layer.
Shidler	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
8 Chigley	Severe: wetness, percs slowly.	Severe: wetness.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
9 Chigley	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
10*:					
Chigley	Severe: wetness, percs slowly, slope.	Severe: slope, wetness.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Naru	Severe: percs slowly, slope.	Severe: large stones, slope.	Severe: slope, large stones, depth to rock.	Severe: slope.	Poor: slope.
11*:					
Chigley	Severe: wetness, percs slowly.	Severe: wetness.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Urban land.					
12*:					
Chigley	Severe: wetness, percs slowly.	Severe: wetness.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
12*:					
Clarita	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
13*:					
Claremore	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, thin layer.
Rock outcrop.					
14*:					
Claremore	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, thin layer.
Urban land.					
15 Clarita	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
16 Clarita	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
17*:					
Clarita	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Urban land.					
18 Dale	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
19 Durant	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
20, 21, 22 Durant	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
23*:					
Durant	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Urban land.					
24 Elandco	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
25 Eufaula	Severe: poor filter.	Severe: seepage.	Moderate: too sandy.	Severe: seepage.	Poor: seepage.
26, 27, 28 Fitzhugh	Moderate: depth to rock, percs slowly.	Moderate: seepage, depth to rock, slope.	Severe: depth to rock.	Moderate: depth to rock.	Fair: area reclaim, too clayey, thin layer.
29 Garvin	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding, too clayey.	Severe: flooding.	Poor: too clayey, hard to pack.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
30*:					
Garvin	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding, too clayey.	Severe: flooding.	Poor: too clayey, hard to pack.
Elandco	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
31, 32, 33 Gasil	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
34 Gasil Variant	Moderate: percs slowly, large stones.	Moderate: seepage, slope, large stones.	Moderate: too clayey, large stones.	Slight	Fair: large stones, too clayey.
35 Grainola	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey, slope.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
36*:					
Kingfisher Variant	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, thin layer.
Rock outcrop.					
37*:					
Kiti	Severe: depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: area reclaim, large stones.
Rock outcrop.					
38*:					
Kiti	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope.	Poor: area reclaim, large stones, slope.
Rock outcrop.					
39*:					
Kiti	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: area reclaim, large stones.
Scullin	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
40 Konawa	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Slight	Good.
41 Konsil	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
42 Lula	Moderate: depth to rock, percs slowly.	Moderate: seepage, depth to rock, slope.	Severe: depth to rock.	Moderate: depth to rock.	Fair: too clayey, area reclaim, thin layer.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
43------------------ McLain	Severe: percs slowly.	Slight-----------	Moderate: flooding, too clayey.	Moderate: flooding.	Poor: hard to pack.
44------------------ Norge Variant	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
45*. Pits					
46------------------ Rayford	Severe: depth to rock, slope.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope.	Poor: area reclaim, slope, thin layer.
47*: Rayford------------	Severe: depth to rock, slope.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope.	Poor: area reclaim, slope, thin layer.
Urban land.					
48, 49-------------- Renfrow	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
50*: Rock outcrop.					
Kiti----------------	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope.	Poor: area reclaim, large stones, slope.
51*: Shidler------------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack, thin layer.
Clarita-------------	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
52*: Shidler------------	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack, thin layer.
Rock outcrop.					
53------------------ Stephenville Variant	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: thin layer, area reclaim.
54*: Stephenville Variant-----------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, thin layer, slope.
Darnell Variant-----	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: area reclaim, thin layer.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
55, 56-------------- Teller	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Slight-----------	Fair: too clayey.
57------------------ Timhill	Severe: depth to rock, slope.	Severe: depth to rock, slope, seepage.	Severe: depth to rock, slope, seepage.	Severe: depth to rock, slope, seepage.	Poor: area reclaim, small stones, slope.
58*:					
Travertine---------	Severe: depth to rock.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: area reclaim, thin layer, large stones.
Bromide------------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, large stones, slope.	Severe: depth to rock, slope.	Poor: area reclaim, large stones, slope.
59------------------ Tussy	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack, small stones.
60------------------ Tussy	Severe: percs slowly, slope.	Severe: slope.	Severe: too clayey, slope.	Severe: slope.	Poor: too clayey, hard to pack, slope.
61, 62-------------- Watonga	Severe: percs slowly.	Slight-----------	Severe: too clayey.	Moderate: flooding.	Poor: too clayey, hard to pack.
63------------------ Wilson	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
64, 65-------------- Yahola	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1, 2, 3---------------- Bastrop	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
4*:				
Bastrop---------------	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
Urban land.				
5*:				
Bastrop---------------	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
Konawa----------------	Good------------------	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
6--------------------- Burleson	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
7*:				
Catoosa---------------	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer, too clayey.
Shidler---------------	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, thin layer.
8, 9------------------ Chigley	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, too clayey.
10*:				
Chigley---------------	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope, too clayey.
Naru------------------	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, large stones.
11*:				
Chigley---------------	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, too clayey.
Urban land.				
12*:				
Chigley---------------	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, too clayey.
Clarita---------------	Poor: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
13*:				
Claremore-------------	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, thin layer.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
13*:				
Rock outcrop.				
14*:				
Claremore	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, thin layer.
Urban land.				
15, 16 Clarita	Poor: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
17*:				
Clarita	Poor: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Urban land.				
18 Dale	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
19, 20, 21, 22 Durant	Poor: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
23*:				
Durant	Poor: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Urban land.				
24 Elandco	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
25 Eufaula	Good	Probable	Improbable: too sandy.	Fair: too sandy.
26, 27, 28 Fitzhugh	Fair: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
29 Garvin	Poor: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
30*:				
Garvin	Poor: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Elandco	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
31, 32, 33 Gasil	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
34 Gasil Variant	Fair: large stones, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones.
35 Grainola	Poor: area reclaim, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, slope.
36*:				
Kingfisher Variant	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey, thin layer.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
36*: Rock outcrop.				
37*: Kiti	Poor: area reclaim, large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, large stones.
Rock outcrop.				
38*: Kiti	Poor: area reclaim, large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, large stones, slope.
Rock outcrop.				
39*: Kiti	Poor: area reclaim, large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, large stones.
Scullin	Poor: area reclaim, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
40 Konawa	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
41 Konsil	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
42 Lula	Fair: shrink-swell, area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Good.
43 McLain	Poor: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
44 Norge Variant	Moderate: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
45*. Pits				
46 Rayford	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope, large stones.
47*: Rayford	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope, large stones.
Urban land.				
48, 49 Renfrow	Poor: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
50*: Rock outcrop.				

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
50*:				
Kiti	Poor: area reclaim, large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, large stones, slope.
51*:				
Shidler	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, thin layer.
Clarita	Poor: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
52*:				
Shidler	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, thin layer.
Rock outcrop.				
53 Stephenville Variant	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey.
54*:				
Stephenville Variant	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Darnell Variant	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, thin layer.
55, 56 Teller	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
57 Timhill	Poor: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones, slope.
58*:				
Travertine	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones.
Bromide	Poor: area reclaim.	Improbable: excess fines, thin layer.	Improbable: excess fines, thin layer.	Poor: large stones, slope.
59 Tussy	Poor: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
60 Tussy	Poor: slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
61, 62 Watonga	Poor: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
63 Wilson	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
64 Yahola	Good	Improbable: excess fines.	Improbable: excess fines.	Good.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
65-------------------- Yahola	Good------------------	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Map symbol and soil name	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Limitations for-- Aquifer-fed excavated ponds	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
1: Bastrop	Moderate: seepage.	Moderate: piping.	Severe: no water.	Soil blowing	Erodes easily, soil blowing.	Erodes easily.
2, 3: Bastrop	Moderate: seepage.	Moderate: piping.	Severe: no water.	Soil blowing, slope.	Erodes easily, soil blowing.	Erodes easily.
4*:						
Bastrop	Moderate: seepage.	Moderate: piping.	Severe: no water.	Soil blowing, slope.	Erodes easily, soil blowing.	Erodes easily.
Urban land.						
5*:						
Bastrop	Moderate: seepage.	Moderate: piping.	Severe: no water.	Soil blowing, slope.	Erodes easily, soil blowing.	Erodes easily.
Konawa	Severe: seepage.	Moderate: piping.	Severe: no water.	Droughty, fast intake, slope.	Soil blowing	Droughty.
6: Burleson	Slight	Severe: hard to pack.	Severe: no water.	Slow intake, percs slowly.	Percs slowly	Percs slowly.
7*:						
Catoosa	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Severe: no water.	Depth to rock, rooting depth, slope.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
Shidler	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Depth to rock, slope.	Depth to rock	Depth to rock.
8: Chigley	Moderate: slope.	Moderate: piping, hard to pack.	Severe: no water.	Slope	Favorable	Favorable.
9: Chigley	Severe: slope.	Moderate: piping, hard to pack.	Severe: no water.	Slope	Slope	Slope.
10*:						
Chigley	Severe: slope.	Moderate: piping, hard to pack.	Severe: no water.	Slope	Slope	Slope.
Naru	Severe: slope.	Severe: large stones.	Severe: no water.	Large stones, slope, percs slowly.	Slope, large stones, percs slowly.	Slope, large stones, percs slowly.
11*:						
Chigley	Moderate: slope.	Moderate: piping, hard to pack.	Severe: no water.	Slope	Favorable	Favorable.
Urban land.						
12*:						
Chigley	Moderate: slope.	Moderate: piping, hard to pack.	Severe: no water.	Slope	Favorable	Favorable.
Clarita	Moderate: slope.	Severe: hard to pack.	Severe: no water.	Slow intake, percs slowly, slope.	Erodes easily, percs slowly.	Erodes easily, percs slowly.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Limitations for-- Aquifer-fed excavated ponds	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
13*:						
Claremore--------	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Depth to rock, slope, erodes easily.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
Rock outcrop.						
14*:						
Claremore--------	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Depth to rock, slope, erodes easily.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
Urban land.						
15----------------- Clarita	Moderate: slope.	Severe: hard to pack.	Severe: no water.	Slow intake, percs slowly, slope.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
16----------------- Clarita	Severe: slope.	Severe: hard to pack.	Severe: no water.	Slow intake, percs slowly, slope.	Erodes easily, percs slowly, slope.	Erodes easily, percs slowly, slope.
17*:						
Clarita----------	Severe: slope.	Severe: hard to pack.	Severe: no water.	Slow intake, percs slowly, slope.	Erodes easily, percs slowly, slope.	Erodes easily, percs slowly, slope.
Urban land.						
18----------------- Dale	Moderate: seepage.	Moderate: piping.	Severe: no water.	Erodes easily	Erodes easily	Erodes easily.
19, 20------------ Durant	Slight---------	Moderate: hard to pack.	Severe: no water.	Percs slowly, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
21, 22------------ Durant	Moderate: slope.	Moderate: hard to pack.	Severe: no water.	Percs slowly, slope, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
23*:						
Durant-----------	Moderate: slope.	Moderate: hard to pack.	Severe: no water.	Percs slowly, slope, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Urban land.						
24----------------- Elandco	Moderate: seepage.	Severe: piping.	Severe: no water.	Erodes easily, flooding.	Erodes easily	Erodes easily.
25----------------- Eufaula	Severe: seepage.	Severe: seepage.	Severe: no water.	Fast intake, droughty, soil blowing.	Soil blowing---	Droughty.
26----------------- Fitzhugh	Moderate: seepage, depth to rock.	Moderate: piping, thin layer.	Severe: no water.	Erodes easily	Erodes easily	Erodes easily.
27, 28------------ Fitzhugh	Moderate: seepage, depth to rock, slope.	Moderate: piping, thin layer.	Severe: no water.	Slope, erodes easily.	Erodes easily	Erodes easily.
29----------------- Garvin	Slight---------	Moderate: hard to pack.	Severe: no water.	Slow intake, percs slowly, erodes easily.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
30*:						
Garvin-----------	Slight---------	Moderate: hard to pack.	Severe: no water.	Slow intake, percs slowly, erodes easily.	Percs slowly, erodes easily.	Percs slowly, erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Irrigation	Terraces and diversions	Grassed waterways
30*:						
Elandco----------	Moderate: seepage.	Severe: piping.	Severe: no water.	Erodes easily, flooding.	Erodes easily	Erodes easily.
31, 32----------- Gasil	Moderate: seepage.	Severe: piping.	Severe: no water.	Soil blowing, slope.	Soil blowing---	Favorable.
33--------------- Gasil	Moderate: seepage.	Severe: piping.	Severe: no water.	Soil blowing---	Soil blowing---	Favorable.
34--------------- Gasil Variant	Moderate: seepage, slope.	Moderate: large stones.	Severe: no water.	Large stones, slope.	Large stones---	Large stones.
35--------------- Grainola	Severe: slope.	Moderate: thin layer, hard to pack, large stones.	Severe: no water.	Large stones, percs slowly, depth to rock.	Large stones, depth to rock, slope.	Large stones, depth to rock, slope.
36*:						
Kingfisher Variant---------	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Severe: no water.	Depth to rock, slope, erodes easily.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
Rock outcrop.						
37*:						
Kiti-------------	Severe: depth to rock.	Severe: piping, large stones.	Severe: no water.	Large stones, droughty, depth to rock.	Large stones, depth to rock.	Large stones, droughty.
Rock outcrop.						
38*:						
Kiti-------------	Severe: depth to rock, slope.	Severe: piping, large stones.	Severe: no water.	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Rock outcrop.						
39*:						
Kiti-------------	Severe: depth to rock.	Severe: piping, large stones.	Severe: no water.	Large stones, droughty, depth to rock.	Large stones, depth to rock.	Large stones, droughty.
Scullin----------	Moderate: depth to rock, slope.	Severe: thin layer.	Severe: no water.	Depth to rock, slope.	Depth to rock	Depth to rock.
40--------------- Konawa	Severe: seepage.	Moderate: piping.	Severe: no water.	Favorable------	Soil blowing---	Favorable.
41--------------- Konsil	Moderate: seepage.	Moderate: piping.	Severe: no water.	Soil blowing, slope.	Soil blowing---	Favorable.
42--------------- Lula	Moderate: depth to rock, seepage.	Moderate: thin layer.	Severe: no water.	Erodes easily	Erodes easily	Erodes easily.
43--------------- McLain	Slight---------	Severe: hard to pack.	Severe: no water.	Percs slowly, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
44--------------- Norge Variant	Slight---------	Moderate: piping.	Severe: no water.	Percs slowly, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
45*. Pits						

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Irrigation	Terraces and diversions	Grassed waterways
46 Rayford	Severe: depth to rock, slope.	Severe: thin layer, large stones.	Severe: no water.	Large stones, depth to rock, slope.	Large stones, slope, depth to rock.	Large stones, slope, depth to rock.
47*:						
Rayford	Severe: depth to rock, slope.	Severe: thin layer, large stones.	Severe: no water.	Large stones, depth to rock, slope.	Large stones, slope, depth to rock.	Large stones, slope, depth to rock.
Urban land.						
48 Renfrow	Slight	Severe: hard to pack.	Severe: no water.	Percs slowly, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
49 Renfrow	Slight	Severe: hard to pack.	Severe: no water.	Percs slowly, slope, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
50*: Rock outcrop.						
Kiti	Severe: depth to rock, slope.	Severe: piping, large stones.	Severe: no water.	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
51*:						
Shidler	Severe: depth to rock.	Severe: thin layer, hard to pack.	Severe: no water.	Depth to rock, slope.	Depth to rock	Depth to rock.
Clarita	Moderate: slope.	Severe: hard to pack.	Severe: no water.	Slow intake, percs slowly, slope.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
52*:						
Shidler	Severe: depth to rock.	Severe: thin layer, hard to pack.	Severe: no water.	Depth to rock, slope.	Depth to rock	Depth to rock.
Rock outcrop.						
53 Stephenville Variant	Moderate: depth to rock, seepage, slope.	Moderate: thin layer, piping.	Severe: no water.	Depth to rock, slope.	Depth to rock	Depth to rock.
54*:						
Stephenville Variant	Severe: slope.	Moderate: thin layer, piping.	Severe: no water.	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
Darnell Variant	Severe: seepage, depth to rock.	Severe: thin layer.	Severe: no water.	Depth to rock, slope.	Depth to rock	Depth to rock.
55, 56 Teller	Moderate: seepage.	Severe: piping.	Severe: no water.	Erodes easily	Erodes easily	Erodes easily.
57 Timhill	Severe: depth to rock, slope, seepage.	Severe: thin layer.	Severe: no water.	Depth to rock, slope, large stones.	Large stones, depth to rock, slope.	Large stones, slope, depth to rock.
58*:						
Travertine	Severe: depth to rock.	Severe: thin layer, piping, large stones.	Severe: no water.	Large stones, depth to rock, slope.	Large stones, depth to rock.	Large stones, depth to rock.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Limitations for-- Aquifer-fed excavated ponds	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
58*:						
Bromide	Severe: slope.	Severe: large stones.	Severe: no water.	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
59 Tussy	Moderate: slope.	Moderate: hard to pack.	Severe: no water.	Slow intake, percs slowly, slope.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
60 Tussy	Severe: slope.	Moderate: hard to pack.	Severe: no water.	Slow intake, percs slowly, slope.	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
61 Watonga	Slight	Moderate: hard to pack.	Severe: no water.	Slow intake, percs slowly, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
62 Watonga	Slight	Moderate: hard to pack.	Severe: no water.	Percs slowly, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
63 Wilson	Slight	Severe: hard to pack, wetness.	Severe: no water.	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
64 Yahola	Severe: seepage.	Severe: piping.	Severe: no water.	Soil blowing, flooding.	Soil blowing	Favorable.
65 Yahola	Severe: seepage.	Severe: piping.	Severe: no water.	Fast intake, soil blowing, flooding.	Soil blowing	Droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated. Some soils have Unified classifications and USDA textures that are supplementary to those shown. In general, the dominant classifications and textures are shown, and the others are inferred]

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
1----------------- Bastrop	0-8	Fine sandy loam	ML, SM, CL-ML, SM-SC	A-4	0	95-100	80-100	80-100	40-65	18-25	2-7
	8-70	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	95-100	80-100	80-100	40-70	26-40	11-22
2----------------- Bastrop	0-12	Fine sandy loam	ML, SM, CL-ML, SM-SC	A-4	0	95-100	80-100	80-100	40-65	18-25	2-7
	12-72	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	95-100	80-100	80-100	40-70	26-40	11-22
3----------------- Bastrop	0-7	Loam-------------	ML, SM, CL-ML, SM-SC	A-4	0	95-100	80-100	80-100	40-65	18-25	2-7
	7-79	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	95-100	80-100	80-100	40-70	26-40	11-22
4*:											
Bastrop----------	0-8	Loam-------------	ML, SM, CL-ML, SM-SC	A-4	0	95-100	80-100	80-100	40-65	18-25	2-7
	8-70	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	95-100	80-100	80-100	40-70	26-40	11-22
Urban land.											
5*:											
Bastrop----------	0-4	Fine sandy loam	ML, SM, CL-ML, SM-SC	A-4	0	95-100	80-100	80-100	40-65	18-25	2-7
	4-72	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	95-100	80-100	80-100	40-70	26-40	11-22
Konawa-----------	0-10	Loamy fine sand	SM	A-2	0	98-100	98-100	85-100	15-35	---	NP
	10-50	Sandy clay loam, fine sandy loam.	SC, CL	A-4, A-6	0	98-100	98-100	85-100	40-60	26-40	8-18
	50-72	Fine sandy loam, sandy clay loam, loamy fine sand.	SM, SC, CL, ML	A-4, A-6, A-2	0	98-100	98-100	85-100	15-60	<34	NP-14
6----------------- Burleson	0-29	Clay-------------	CH	A-7-6, A-7-5	0-2	83-100	80-100	80-100	80-96	51-90	27-55
	29-72	Clay, silty clay	CH	A-7-6, A-7-5	0-1	95-100	80-100	75-99	70-95	51-90	30-55
7*:											
Catoosa----------	0-10	Silt loam--------	CL	A-4, A-6	0	100	100	96-100	65-97	30-37	8-14
	10-18	Silt loam, loam, clay loam.	CL	A-4, A-6, A-7	0	100	100	96-100	65-98	30-43	8-20
	18-29	Silty clay loam, clay loam.	CL	A-6, A-7	0	85-100	85-100	85-100	70-98	33-48	12-22
	29-31	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Shidler----------	0-12	Silty clay loam	CL	A-4, A-6	0-25	75-100	75-100	70-100	60-97	30-37	8-13
	12-14	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
8, 9: Chigley	0-6	Gravelly sandy loam.	SM, SM-SC	A-2, A-4	0	55-75	55-75	50-75	20-45	<25	NP-4
	6-38	Sandy clay, clay, gravelly clay loam.	CL, CH, SC	A-2, A-6, A-7	0	50-90	50-90	50-90	20-85	35-60	14-35
	38-54	Sandy clay, clay, gravelly sandy clay loam.	CL, CH, SC	A-2, A-6, A-7	0	50-90	50-90	50-90	15-85	25-60	11-35
	54-64	Gravelly sandy clay, gravelly clay, very gravelly clay loam.	SC, GC, CL, CH	A-2, A-6, A-7	0	35-70	35-70	35-70	13-65	25-60	11-35
10*: Chigley	0-9	Gravelly sandy loam.	SM, SM-SC	A-2, A-4	0	55-75	55-75	50-75	20-45	<25	NP-4
	9-35	Sandy clay, clay, gravelly clay loam.	CL, CH, SC	A-2, A-6, A-7	0	50-90	50-90	50-90	20-85	35-60	14-35
	35-46	Sandy clay, clay, gravelly sandy clay loam.	CL, CH, SC	A-2, A-6, A-7	0	50-90	50-90	50-90	15-85	25-60	11-35
	46-54	Gravelly sandy clay, gravelly clay, very gravelly clay loam.	SC, GC, CL, CH	A-2, A-6, A-7	0	35-70	35-70	35-70	13-65	25-60	11-35
	54-56	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Naru	0-15	Cobbly loam	CL, CL-ML, GM-GC, GC	A-4, A-6	30-50	55-75	55-75	50-75	36-65	25-35	4-14
	15-36	Cobbly clay loam, cobbly loam, very cobbly loam.	CL, GC	A-4, A-5, A-6, A-7	30-55	55-75	55-75	50-75	36-70	30-45	8-20
	36-58	Shaly clay	CL	A-6, A-7	---	90-100	90-100	85-95	80-85	35-50	15-25
	58-70	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
11*: Chigley	0-6	Gravelly sandy loam.	SM, SM-SC	A-2, A-4	0	55-75	55-75	50-75	20-45	<25	NP-4
	6-38	Sandy clay, clay, gravelly clay loam.	CL, CH, SC	A-2, A-6, A-7	0	50-90	50-90	50-90	20-85	35-60	14-35
	38-54	Sandy clay, clay, gravelly sandy clay loam.	CL, CH, SC	A-2, A-6, A-7	0	50-90	50-90	50-90	15-85	25-60	11-35
	54-64	Gravelly sandy clay, gravelly clay, very gravelly clay loam.	SC, GC, CL, CH	A-2, A-6, A-7	0	35-70	35-70	35-70	13-65	25-60	11-35
Urban land.											

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
12*:											
Chigley----------	0-5	Gravelly sandy loam.	SM, SM-SC	A-2, A-4	0	55-75	55-75	50-75	20-45	<25	NP-4
	5-34	Sandy clay, clay, gravelly clay loam.	CL, CH, SC	A-2, A-6, A-7	0	50-90	50-90	50-90	20-85	35-60	14-35
	34-48	Sandy clay, clay, gravelly sandy clay loam.	CL, CH, SC	A-2, A-6, A-7	0	50-90	50-90	50-90	15-85	25-60	11-35
	48-80	Gravelly sandy clay, gravelly clay, very gravelly clay loam.	SC, GC, CL, CH	A-2, A-6, A-7	0	35-70	35-70	35-70	13-65	25-60	11-35
Clarita----------	0-14	Clay--------------	CL, CH	A-7	0	95-100	95-100	95-100	90-99	41-60	20-35
	14-40	Clay, silty clay, silty clay loam.	CL, CH	A-6, A-7	0	95-100	95-100	95-100	80-99	37-60	15-35
	40-80	Clay--------------	CL, CH	A-7	0	85-100	85-100	85-100	80-95	45-60	20-35
13*:											
Claremore--------	0-10	Loam--------------	ML, CL, CL-ML	A-4, A-6	0	90-100	90-100	90-100	60-97	22-35	2-14
	10-18	Silty clay loam, clay loam.	CL	A-6, A-7	0	90-100	90-100	90-100	70-98	33-43	12-20
	18-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
14*:											
Claremore--------	0-10	Loam--------------	ML, CL, CL-ML	A-4, A-6	0	90-100	90-100	90-100	60-97	22-35	2-14
	10-18	Silty clay loam, silt loam.	CL	A-4, A-6, A-7	0	90-100	90-100	90-100	80-98	22-42	2-19
	18-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Urban land.											
15---------------- Clarita	0-8	Clay--------------	CL, CH	A-7	0	95-100	95-100	95-100	90-99	41-60	20-35
	8-35	Clay, silty clay, silty clay loam.	CL, CH	A-6, A-7	0	95-100	95-100	95-100	80-99	37-60	15-35
	35-65	Clay--------------	CL, CH	A-7	0	85-100	85-100	85-100	80-95	45-60	20-35
16---------------- Clarita	0-6	Clay--------------	CL, CH	A-7	0	95-100	95-100	95-100	90-99	41-60	20-35
	6-38	Clay, silty clay, silty clay loam.	CL, CH	A-6, A-7	0	95-100	95-100	95-100	80-99	37-60	15-35
	38-80	Clay--------------	CL, CH	A-7	0	85-100	85-100	85-100	80-95	45-60	20-35
17*:											
Clarita----------	0-8	Clay--------------	CL, CH	A-7	0	95-100	95-100	95-100	90-99	41-60	20-35
	8-35	Clay, silty clay, silty clay loam.	CL, CH	A-6, A-7	0	95-100	95-100	95-100	80-99	37-60	15-35
	35-65	Clay--------------	CL, CH	A-7	0	85-100	85-100	85-100	80-95	45-60	20-35
Urban land.											
18---------------- Dale	0-22	Silt loam---------	CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	65-98	25-35	5-15
	22-75	Silt loam, loam, silty clay loam.	CL	A-4, A-6, A-7	0	95-100	95-100	90-100	65-98	30-43	8-20
19---------------- Durant	0-11	Loam--------------	CL	A-4, A-6	0	100	100	96-100	65-97	30-37	8-14
	11-17	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0	100	100	96-100	80-98	37-70	15-39
	17-65	Clay--------------	CL, CH, MH	A-7	0	100	100	96-100	80-95	45-70	21-39

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
20---------------- Durant	0-9	Loam--------------	CL	A-4, A-6	0	100	100	96-100	65-97	30-37	8-14
	9-15	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0	100	100	96-100	80-98	37-70	15-39
	15-64	Clay--------------	CL, CH, MH	A-7	0	100	100	96-100	80-95	45-70	21-39
21---------------- Durant	0-7	Loam--------------	CL	A-4, A-6	0	100	100	96-100	65-97	30-37	8-14
	7-17	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0	100	100	96-100	80-98	37-70	15-39
	17-75	Clay--------------	CL, CH, MH	A-7	0	100	100	96-100	80-95	45-70	21-39
22---------------- Durant	0-14	Loam--------------	CL	A-4, A-6	0	100	100	96-100	65-97	30-37	8-14
	14-18	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0	100	100	96-100	80-98	37-70	15-39
	18-70	Clay--------------	CL, CH, MH	A-7	0	100	100	96-100	80-95	45-70	21-39
23*:											
Durant-----------	0-9	Loam--------------	CL	A-4, A-6	0	100	100	96-100	65-97	30-37	8-14
	9-15	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0	100	100	96-100	80-98	37-70	15-39
	15-64	Clay--------------	CL, CH, MH	A-7	0	100	100	96-100	80-95	45-70	21-39
Urban land.											
24---------------- Elandco	0-21	Silt loam---------	CL, ML, CL-ML	A-4, A-6	0	100	100	95-100	85-95	20-40	4-20
	21-75	Silty clay loam, clay loam, silt loam.	CL, ML, CL-ML	A-4, A-6, A-7-6	0	100	100	95-100	65-95	20-45	4-25
25---------------- Eufaula	0-80	Loamy fine sand	SM, SP-SM	A-2, A-3	0	100	98-100	82-100	5-35	<25	NP-4
26---------------- Fitzhugh	0-14	Loam--------------	CL, ML, CL-ML	A-4, A-6	0	100	100	94-100	51-85	<31	NP-10
	14-54	Sandy clay loam, loam, clay loam.	CL, SC	A-4, A-6	0	100	100	90-100	36-90	25-40	8-18
	54-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
27---------------- Fitzhugh	0-6	Loam--------------	CL, ML, CL-ML	A-4, A-6	0	100	100	94-100	51-85	<31	NP-10
	6-42	Sandy clay loam, loam, clay loam.	CL, SC	A-4, A-6	0	100	100	90-100	36-90	25-40	8-18
	42-44	Weathered bedrock	---	---	---	---	---	---	---	---	---
28---------------- Fitzhugh	0-4	Loam--------------	CL, ML, CL-ML	A-4, A-6	0	100	100	94-100	51-85	<31	NP-10
	4-45	Sandy clay loam, loam, clay loam.	CL, SC	A-4, A-6	0	100	100	90-100	36-90	25-40	8-18
	45-47	Weathered bedrock	---	---	---	---	---	---	---	---	---
29---------------- Garvin	0-22	Silty clay--------	CL, CH	A-7	0	100	100	96-100	90-99	41-60	18-34
	22-80	Clay, silty clay, clay loam.	CL, CH	A-6, A-7	0	95-100	95-100	95-100	80-99	37-60	15-34
30*:											
Garvin-----------	0-22	Silty clay--------	CL, CH	A-7	0	100	100	96-100	90-99	41-60	18-34
	22-75	Clay, silty clay, clay loam.	CL, CH	A-6, A-7	0	95-100	95-100	95-100	80-99	37-60	15-34
Elandco----------	0-34	Silt loam---------	CL, ML, CL-ML	A-4, A-6	0	100	100	95-100	85-95	20-40	4-20
	34-75	Silty clay loam, clay loam, silt loam.	CL, ML, CL-ML	A-4, A-6, A-7-6	0	100	100	95-100	65-95	20-45	4-25

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
31---------------- Gasil	0-7	Fine sandy loam	CL, ML, SC, SM	A-4	0	95-100	95-100	85-99	36-55	20-28	3-10
	7-72	Sandy clay loam, loam, fine sandy loam.	CL, SC, CL-ML, SM-SC	A-6, A-4	0	95-100	95-100	85-100	36-71	22-40	7-20
32---------------- Gasil	0-4	Fine sandy loam	CL, ML, SC, SM	A-4	0	95-100	95-100	85-99	36-55	20-28	3-10
	4-80	Sandy clay loam, loam, fine sandy loam.	CL, SC, CL-ML, SM-SC	A-6, A-4	0	95-100	95-100	85-100	36-71	22-40	7-20
33---------------- Gasil	0-16	Fine sandy loam	CL, ML, SC, SM	A-4	0	95-100	95-100	85-99	36-55	20-28	3-10
	16-80	Sandy clay loam, loam, fine sandy loam.	CL, SC, CL-ML, SM-SC	A-6, A-4	0	95-100	95-100	85-100	36-71	22-40	7-20
34---------------- Gasil Variant	0-13	Shaly silt loam	ML, CL, CL-ML	A-4	10-15	90-100	85-100	80-100	55-97	22-31	2-10
	13-40	Shaly silty clay loam, shaly silt loam, very shaly silty clay loam.	CL, SC	A-4, A-6, A-7	40-50	55-90	50-85	45-85	40-85	30-42	8-19
	40-75	Silty clay loam, silt loam, shaly silty clay loam.	CL	A-4, A-6, A-7	0-10	80-100	75-100	70-100	60-98	30-42	8-19
35---------------- Grainola	0-8	Cobbly clay loam	CL, SC, GC	A-2, A-6, A-7	25-55	40-95	40-95	40-95	30-95	37-50	14-25
	8-28	Clay loam, clay, very shaly silty clay.	CL, CH	A-7	0	20-90	20-90	20-90	15-90	41-70	20-40
	28-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
36*: Kingfisher Variant---------	0-12	Silt loam---------	CL	A-4, A-6	0	95-100	95-100	95-100	65-97	30-37	8-14
	12-16	Silt loam, silty clay loam.	CL	A-4, A-6, A-7	0	95-100	95-100	95-100	80-98	30-42	8-20
	16-35	Silty clay loam	CL	A-6, A-7	0	85-100	85-100	80-100	75-98	33-42	12-20
	35-40	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
37*: Kiti-------------	0-14	Very flaggy loam	CL	A-4, A-6	45-75	85-95	85-90	75-90	55-90	30-37	8-14
	14-16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
38*: Kiti-------------	0-12	Very flaggy loam	CL	A-4, A-6	45-75	85-95	85-90	75-90	55-90	30-37	8-14
	12-15	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
39*:											
Kiti------------	0-15	Very flaggy silty clay loam.	CL	A-6, A-7	45-75	85-95	85-90	75-90	65-90	33-43	12-20
	15-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Scullin---------	0-7	Clay loam--------	CL	A-6, A-7	0	75-90	75-90	70-90	60-80	34-43	13-20
	7-12	Loam, clay loam, flaggy clay loam.	CL, SC	A-6, A-4, A-7	0	50-90	50-90	45-90	36-80	30-43	8-20
	12-34	Clay, clay loam, very flaggy clay.	CL, CH, GC, SC	A-7, A-6, A-2	0	35-90	35-90	30-90	25-85	37-60	16-34
	34-40	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
40--------------- Konawa	0-16	Fine sandy loam	CL-ML, ML, SM, SM-SC	A-4	0	98-100	98-100	90-100	40-60	<26	NP-7
	16-64	Sandy clay loam, fine sandy loam.	SC, CL	A-4, A-6	0	98-100	98-100	85-100	40-60	26-40	8-18
	64-78	Fine sandy loam, sandy clay loam, loamy fine sand.	SM, SC, CL, ML	A-4, A-6, A-2	0	98-100	98-100	85-100	15-60	<34	NP-14
41--------------- Konsil	0-10	Fine sandy loam	CL, ML, SC, SM	A-4	0	90-100	90-100	85-98	36-55	<28	NP-10
	10-72	Sandy clay loam, loam, fine sandy loam.	CL, SC	A-6	0	90-100	90-100	85-99	40-60	28-40	11-20
42--------------- Lula	0-12	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	96-100	65-97	21-37	1-15
	12-18	Silty clay loam, clay loam, silt loam.	CL	A-6, A-4, A-7	0	100	100	96-100	65-98	30-43	9-20
	18-58	Silty clay loam, clay loam.	CL	A-6, A-7	0	95-100	95-100	95-100	75-98	33-50	12-26
	58-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
43--------------- McLain	0-24	Silty clay loam	CL	A-6, A-7	0	100	100	96-100	80-99	33-43	13-19
	24-60	Silty clay loam, clay loam, silty clay.	CL, CH	A-6, A-7	0	100	100	96-100	80-99	37-60	15-34
	60-75	Silt loam, loam, silty clay loam.	CL, CH	A-4, A-6, A-7	0	100	95-100	95-100	65-99	27-60	7-34
44--------------- Norge Variant	0-12	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	96-100	80-97	25-37	3-13
	12-21	Silt loam, clay loam, silty clay loam.	CL	A-4, A-6, A-7	0	100	100	96-100	80-98	30-43	8-20
	21-55	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	96-100	80-98	33-43	12-20
	55-75	Clay, silty clay, silty clay loam.	CL, CH	A-6, A-7	0	75-90	75-90	70-90	65-90	37-60	15-34
	75-80	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
45*. Pits											
46--------------- Rayford	0-11	Cobbly loam------	CL	A-4, A-6	25-40	80-90	75-85	70-80	50-70	30-37	9-14
	11-16	Cobbly loam, cobbly clay loam, cobbly silty clay loam.	CL, SC	A-4, A-6, A-7	40-55	75-90	70-85	65-80	45-70	30-43	9-20
	16-18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
47*:											
Rayford----------	0-8	Cobbly loam------	CL	A-4, A-6	25-40	80-90	75-85	70-80	50-70	30-37	9-14
	8-14	Cobbly loam, cobbly clay loam, cobbly silty clay loam.	CL, SC	A-4, A-6, A-7	40-55	75-90	70-85	65-80	45-70	30-43	9-20
	14-18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Urban land.											
48---------------- Renfrow	0-10	Silt loam--------	CL	A-4, A-6	0	100	100	96-100	65-97	30-37	8-14
	10-16	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	96-100	80-98	37-49	15-26
	16-62	Clay, silty clay, silty clay loam.	CL, CH	A-6, A-7	0	100	100	96-100	80-99	37-70	15-38
49---------------- Renfrow	0-9	Silt loam--------	CL	A-4, A-6	0	100	100	96-100	65-97	30-37	8-14
	9-15	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	96-100	80-98	37-49	15-26
	15-58	Clay, silty clay, silty clay loam.	CL, CH	A-6, A-7	0	100	100	96-100	80-99	37-70	15-38
50*: Rock outcrop.											
Kiti-------------	0-12	Very flaggy loam	CL	A-4, A-6	45-75	85-95	85-90	75-90	55-90	30-37	8-14
	12-15	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
51*:											
Shidler----------	0-10	Silty clay loam	CL, CH	A-6, A-7	0-25	75-100	75-100	70-100	65-98	33-55	12-27
	10-14	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Clarita----------	0-14	Silty clay-------	CL, CH	A-7	0	95-100	95-100	95-100	90-99	41-60	20-35
	14-60	Clay-------------	CL, CH	A-7	0	85-100	85-100	85-100	80-95	45-60	20-35
52*:											
Shidler----------	0-8	Silty clay loam	CL, CH	A-6, A-7	0-25	75-100	75-100	70-100	65-98	33-55	12-27
	8-10	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
53---------------- Stephenville Variant	0-14	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-4	0	100	98-100	94-100	36-60	<26	NP-7
	14-36	Sandy clay loam, fine sandy loam.	CL, SC	A-4, A-6	0	100	100	90-100	36-65	25-37	7-16
	36-40	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
54*:											
Stephenville Variant---------	0-14	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-4	0	100	98-100	94-100	36-60	<26	NP-7
	14-32	Sandy clay loam, fine sandy loam.	CL, SC	A-4, A-6	0	100	100	90-100	36-65	25-37	7-16
	32-35	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Darnell Variant-	0-14	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4	0	100	98-100	94-100	36-60	<26	NP-7
	14-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
55---------------- Teller	0-22	Loam-------------	ML, CL, CL-ML	A-4	0	100	100	94-100	51-85	<30	NP-10
	22-56	Sandy clay loam, clay loam.	SC, CL	A-6, A-4	0	100	100	90-100	45-85	24-40	7-18
	56-72	Fine sandy loam, very fine sandy loam, loam.	SM, SC, ML, CL	A-4	0	100	98-100	94-100	36-85	<30	NP-10
56---------------- Teller	0-22	Loam-------------	ML, CL, CL-ML	A-4	0	100	100	94-100	51-85	<30	NP-10
	22-55	Sandy clay loam, clay loam.	SC, CL	A-6, A-4	0	100	100	90-100	45-85	24-40	7-18
	55-75	Fine sandy loam, very fine sandy loam, loam.	SM, SC, ML, CL	A-4	0	100	98-100	94-100	36-85	<30	NP-10
57---------------- Timhill	0-7	Stony silt loam	ML, CL, SM, SC	A-4, A-6	15-40	65-80	60-75	55-75	40-70	22-33	2-12
	7-15	Very gravelly silt loam, very gravelly loam, cobbly silt loam.	SM, SC, GM, GC	A-1, A-2, A-4, A-6	0-25	40-55	35-50	30-50	20-49	22-33	2-12
	15-18	Very gravelly loam.	GP, GP-GC, GP-GM	A-1, A-2	0	10-15	5-10	5-10	3-8	24-32	4-11
	18-30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
58*:											
Travertine-------	0-13	Channery silt loam.	ML, CL, SM, SC	A-4	15-30	75-90	70-85	65-85	45-85	22-31	2-10
	13-18	Extremely channery silt loam, extremely channery loam.	ML, CL, SM, SC	A-4	65-80	75-90	70-85	65-85	45-85	22-31	2-10
	18-26	Weathered bedrock	---	---	---	---	---	---	---	---	---
Bromide----------	0-18	Channery silt loam.	CL, ML, CL-ML	A-4, A-6	15-30	80-95	75-90	65-90	50-85	22-31	2-10
	18-32	Extremely channery silty clay loam, extremely channery silt loam.	CL, SC	A-4, A-6	55-75	65-75	60-70	55-70	45-70	30-40	8-18
	32-36	Extremely channery loam, extremely channery silt loam.	CL, ML, SC, SM	A-4, A-6	70-80	65-75	60-70	50-70	40-70	22-31	2-10
	36-40	Weathered bedrock	---	---	---	---	---	---	---	---	---
59---------------- Tussy	0-6	Clay-------------	CL, CH	A-7	0	70-100	70-100	65-100	60-95	45-60	19-34
	6-28	Clay, silty clay	CL, CH	A-7	0-5	85-100	85-100	80-100	75-95	45-60	19-34
	28-60	Clay, shaly clay, silty clay loam.	CL, CH, GC, SC	A-7	10-25	50-85	50-85	45-85	40-85	37-60	16-34
60---------------- Tussy	0-8	Clay-------------	CL, CH	A-7	0	70-100	70-100	65-100	60-95	45-60	19-34
	8-26	Clay, silty clay	CL, CH	A-7	0-5	85-100	85-100	80-100	75-95	45-60	19-34
	26-60	Clay, shaly clay, silty clay loam.	CL, CH, GC, SC	A-7	10-25	50-85	50-85	45-85	40-85	37-60	16-34
61---------------- Watonga	0-20	Clay-------------	CL, CH	A-7	0	100	98-100	96-100	90-99	45-75	25-45
	20-75	Silty clay, clay, silty clay loam.	CL, CH	A-6, A-7	0	100	98-100	96-100	80-99	40-75	20-45

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
62--------------- Watonga	0-18	Silty clay loam	CL	A-7, A-6	0	100	98-100	96-100	80-98	37-50	15-26
	18-75	Silty clay, clay, silty clay loam.	CL, CH	A-6, A-7	0	100	98-100	96-100	80-99	40-75	20-45
63--------------- Wilson	0-8	Silt loam--------	CL	A-4, A-6	0	95-100	85-100	80-100	60-96	26-38	10-20
	8-44	Silty clay, clay, clay loam.	CL, CH	A-7-6	0	90-100	80-100	80-100	65-96	43-56	26-37
	44-80	Silty clay, clay, silty clay loam.	CL, CH	A-7-6, A-6	0	95-100	90-100	85-100	70-96	38-65	24-48
64--------------- Yahola	0-18	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-4	0	100	95-100	70-100	36-60	<26	NP-7
	18-72	Fine sandy loam, loam, very fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4	0	100	95-100	90-100	36-85	<26	NP-7
65--------------- Yahola	0-18	Loamy fine sand	SM	A-2	0	100	95-100	90-100	15-35	---	NP
	18-70	Fine sandy loam, loam, very fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4	0	100	95-100	90-100	36-85	<26	NP-7

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	G/cm^3	In/hr	In/in	pH	Mmhos/cm					Pct
1---------------- Bastrop	0-8	5-20	1.50-1.65	2.0-6.0	0.11-0.17	5.6-7.3	<2	Low--------	0.37	5	3	.5-1
	8-70	20-35	1.55-1.65	0.6-2.0	0.15-0.19	5.6-8.4	<2	Low--------	0.32			
2---------------- Bastrop	0-12	5-20	1.50-1.65	2.0-6.0	0.11-0.17	5.6-7.3	<2	Low--------	0.37	5	3	.5-1
	12-72	20-35	1.55-1.65	0.6-2.0	0.15-0.19	5.6-8.4	<2	Low--------	0.32			
3---------------- Bastrop	0-7	5-20	1.50-1.65	2.0-6.0	0.11-0.17	5.6-7.3	<2	Low--------	0.37	5	3	.5-1
	7-79	20-35	1.55-1.65	0.6-2.0	0.15-0.19	5.6-8.4	<2	Low--------	0.32			
4*:												
Bastrop----------	0-8	5-20	1.50-1.65	2.0-6.0	0.11-0.17	5.6-7.3	<2	Low--------	0.37	5	3	.5-1
	8-70	20-35	1.55-1.65	0.6-2.0	0.15-0.19	5.6-8.4	<2	Low--------	0.32			
Urban land.												
5*:												
Bastrop----------	0-4	5-20	1.50-1.65	2.0-6.0	0.11-0.17	5.6-7.3	<2	Low--------	0.37	5	3	.5-1
	4-72	20-35	1.55-1.65	0.6-2.0	0.15-0.19	5.6-8.4	<2	Low--------	0.32			
Konawa-----------	0-10	5-12	1.35-1.50	6.0-20.0	0.06-0.10	5.1-6.5	<2	Low--------	0.20	5	2	.5-1
	10-50	18-30	1.50-1.70	0.6-2.0	0.12-0.16	5.1-6.0	<2	Low--------	0.32			
	50-72	10-24	1.50-1.70	2.0-6.0	0.11-0.15	5.1-7.3	<2	Low--------	0.24			
6---------------- Burleson	0-29	35-60	1.40-1.50	<0.06	0.12-0.18	5.6-8.4	<2	High-------	0.32	5	---	1-3
	29-72	35-60	1.40-1.50	<0.06	0.12-0.18	7.4-8.4	<2	High-------	0.32			
7*:												
Catoosa----------	0-10	15-26	1.30-1.55	0.6-2.0	0.15-0.24	5.6-6.5	<2	Low--------	0.37	2	---	1-3
	10-18	18-30	1.40-1.70	0.6-2.0	0.15-0.24	5.6-6.5	<2	Moderate	0.37			
	18-29	27-39	1.45-1.70	0.6-2.0	0.15-0.22	5.1-7.3	<2	Moderate	0.32			
	29-31	---	---	---	---	---	---	-----------	----			
Shidler----------	0-12	18-26	1.30-1.50	0.6-2.0	0.16-0.24	6.1-8.4	<2	Low--------	0.37	1	---	1-5
	12-14	---	---	---	---	---	---	-----------	----			
8, 9------------- Chigley	0-6	10-18	1.30-1.60	2.0-6.0	0.07-0.14	4.5-7.3	<2	Low--------	0.20	4	---	1-3
	6-38	35-55	1.35-1.60	0.2-0.6	0.09-0.19	5.1-7.3	<2	Moderate	0.28			
	38-54	30-55	1.35-1.65	0.2-0.6	0.08-0.19	6.1-8.4	<2	Moderate	0.28			
	54-64	30-55	1.35-1.65	0.2-0.6	0.06-0.19	6.6-8.4	<2	Moderate	0.24			
10*:												
Chigley----------	0-9	10-18	1.30-1.60	2.0-6.0	0.07-0.14	4.5-7.3	<2	Low--------	0.20	4	---	1-3
	9-35	35-55	1.35-1.60	0.2-0.6	0.09-0.19	5.1-7.3	<2	Moderate	0.28			
	35-46	30-55	1.35-1.65	0.2-0.6	0.08-0.19	6.1-8.4	<2	Moderate	0.28			
	46-54	30-55	1.35-1.65	0.2-0.6	0.06-0.19	6.6-8.4	<2	Moderate	0.24			
	54-56	---	---	---	---	---	---	-----------	----			
Naru-------------	0-15	15-25	1.30-1.55	0.6-2.0	0.10-0.15	5.6-7.3	<2	Low--------	0.32	3	---	1-3
	15-36	18-35	1.45-1.70	0.6-2.0	0.10-0.15	5.6-7.3	<2	Moderate	0.32			
	36-58	30-45	1.35-1.65	0.06-0.2	0.12-0.18	6.6-8.4	<2	Moderate	0.32			
	58-70	---	---	---	---	---	---	-----------	----			
11*:												
Chigley----------	0-6	10-18	1.30-1.60	2.0-6.0	0.07-0.14	4.5-7.3	<2	Low--------	0.20	4	---	1-3
	6-38	35-55	1.35-1.60	0.2-0.6	0.09-0.19	5.1-7.3	<2	Moderate	0.28			
	38-54	30-55	1.35-1.65	0.2-0.6	0.08-0.19	6.1-8.4	<2	Moderate	0.28			
	54-64	30-55	1.35-1.65	0.2-0.6	0.06-0.19	6.6-8.4	<2	Moderate	0.24			
Urban land.												

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH	Mmhos/cm					Pct
12*:												
Chigley----------	0-5	10-18	1.30-1.60	2.0-6.0	0.07-0.14	4.5-7.3	<2	Low--------	0.20	4	---	1-3
	5-34	35-55	1.35-1.60	0.2-0.6	0.09-0.19	5.1-7.3	<2	Moderate	0.28			
	34-48	30-55	1.35-1.65	0.2-0.6	0.08-0.19	6.1-8.4	<2	Moderate	0.28			
	48-80	30-55	1.35-1.65	0.2-0.6	0.06-0.19	6.6-8.4	<2	Moderate	0.24			
Clarita----------	0-14	40-60	1.25-1.55	<0.06	0.12-0.20	6.1-8.4	<2	High-------	0.37	4	---	1-3
	14-40	35-60	1.40-1.70	<0.06	0.12-0.22	7.9-8.4	<2	High-------	0.37			
	40-80	40-60	1.40-1.70	<0.06	0.12-0.18	7.9-8.4	<2	High-------	0.37			
13*:												
Claremore--------	0-10	15-26	1.30-1.50	0.6-2.0	0.16-0.24	5.6-6.5	<2	Low--------	0.37	2	---	1-3
	10-18	27-35	1.45-1.70	0.6-2.0	0.15-0.22	5.6-7.3	<2	Moderate	0.32			
	18-20	---	---	---	---	---	---	-----------	-----			
Rock outcrop.												
14*:												
Claremore--------	0-10	15-26	1.30-1.50	0.6-2.0	0.16-0.24	5.6-6.5	<2	Low--------	0.37	2	---	1-3
	10-18	18-35	1.40-1.65	0.6-2.0	0.16-0.24	5.6-6.5	<2	Moderate	0.37			
	18-20	---	---	---	---	---	---	-----------	-----			
Urban land.												
15---------------- Clarita	0-8	40-60	1.25-1.55	<0.06	0.12-0.20	6.1-8.4	<2	High-------	0.37	4	---	1-3
	8-35	35-60	1.40-1.70	<0.06	0.12-0.22	7.9-8.4	<2	High-------	0.37			
	35-65	40-60	1.40-1.70	<0.06	0.12-0.18	7.9-8.4	<2	High-------	0.37			
16---------------- Clarita	0-6	40-60	1.25-1.55	<0.06	0.12-0.20	6.1-8.4	<2	High-------	0.37	4	---	1-3
	6-38	35-60	1.40-1.70	<0.06	0.12-0.22	7.9-8.4	<2	High-------	0.37			
	38-80	40-60	1.40-1.70	<0.06	0.12-0.18	7.9-8.4	<2	High-------	0.37			
17*:												
Clarita----------	0-8	40-60	1.25-1.55	<0.06	0.12-0.20	6.1-8.4	<2	High-------	0.37	4	---	1-3
	8-35	35-60	1.40-1.70	<0.06	0.12-0.22	7.9-8.4	<2	High-------	0.37			
	35-65	40-60	1.40-1.70	<0.06	0.12-0.18	7.9-8.4	<2	High-------	0.37			
Urban land.												
18---------------- Dale	0-22	15-26	1.30-1.50	0.6-2.0	0.15-0.24	6.1-7.8	<2	Low--------	0.37	5	5	1-3
	22-75	18-35	1.40-1.70	0.6-2.0	0.15-0.24	7.4-8.4	<2	Moderate	0.37			
19---------------- Durant	0-11	20-26	1.30-1.60	0.6-2.0	0.15-0.24	5.1-6.5	<2	Low--------	0.49	5	---	1-3
	11-17	35-45	1.45-1.70	<0.06	0.12-0.22	5.1-7.3	<2	Moderate	0.43			
	17-65	40-60	1.35-1.60	<0.06	0.12-0.18	5.6-8.4	<2	High-------	0.37			
20---------------- Durant	0-9	20-26	1.30-1.60	0.6-2.0	0.15-0.24	5.1-6.5	<2	Low--------	0.49	5	---	1-3
	9-15	35-45	1.45-1.70	<0.06	0.12-0.22	5.1-7.3	<2	Moderate	0.43			
	15-64	40-60	1.35-1.60	<0.06	0.12-0.18	5.6-8.4	<2	High-------	0.37			
21---------------- Durant	0-7	20-26	1.30-1.60	0.6-2.0	0.15-0.24	5.1-6.5	<2	Low--------	0.49	5	---	1-3
	7-17	35-45	1.45-1.70	<0.06	0.12-0.22	5.1-7.3	<2	Moderate	0.43			
	17-75	40-60	1.35-1.60	<0.06	0.12-0.18	5.6-8.4	<2	High-------	0.37			
22---------------- Durant	0-14	20-26	1.30-1.60	0.6-2.0	0.15-0.24	5.1-6.5	<2	Low--------	0.49	5	---	1-3
	14-18	35-45	1.45-1.70	<0.06	0.12-0.22	5.1-7.3	<2	Moderate	0.43			
	18-70	40-60	1.35-1.60	<0.06	0.12-0.18	5.6-8.4	<2	High-------	0.37			
23*:												
Durant-----------	0-9	20-26	1.30-1.60	0.6-2.0	0.15-0.24	5.1-6.5	<2	Low--------	0.49	5	---	1-3
	9-15	35-45	1.45-1.70	<0.06	0.12-0.22	5.1-7.3	<2	Moderate	0.43			
	15-64	40-60	1.35-1.60	<0.06	0.12-0.18	5.6-8.4	<2	High-------	0.37			
Urban land.												
24---------------- Elandco	0-21	18-27	1.30-1.50	0.6-2.0	0.15-0.22	6.6-8.4	<2	Moderate	0.43	5	6	1-3
	21-75	18-35	1.30-1.50	0.6-2.0	0.15-0.22	7.4-8.4	<2	Moderate	0.43			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH	Mmhos/cm					Pct
25----------------- Eufaula	0-80	2-10	1.35-1.70	6.0-20	0.05-0.11	5.1-7.3	<2	Low--------	0.17	5	1	.5-1
26----------------- Fitzhugh	0-14	15-26	1.30-1.60	0.6-2.0	0.13-0.20	5.6-6.5	<2	Low--------	0.37	4	---	1-3
	14-54	18-35	1.40-1.70	0.6-2.0	0.12-0.20	5.1-6.5	<2	Low--------	0.37			
	54-60	---	---	---	---	---	---	-----------	-----			
27----------------- Fitzhugh	0-6	15-26	1.30-1.60	0.6-2.0	0.13-0.20	5.6-6.5	<2	Low--------	0.37	4	---	1-3
	6-42	18-35	1.40-1.70	0.6-2.0	0.12-0.20	5.1-6.5	<2	Low--------	0.37			
	42-44	---	---	---	---	---	---	-----------	-----			
28----------------- Fitzhugh	0-4	15-26	1.30-1.60	0.6-2.0	0.13-0.20	5.6-6.5	<2	Low--------	0.37	4	---	1-3
	4-45	18-35	1.40-1.70	0.6-2.0	0.12-0.20	5.1-6.5	<2	Low--------	0.37			
	45-47	---	---	---	---	---	---	-----------	-----			
29----------------- Garvin	0-22	40-60	1.25-1.45	<0.06	0.12-0.18	6.6-8.4	<2	High-------	0.37	5	---	1-3
	22-80	35-60	1.35-1.65	<0.06	0.12-0.22	7.9-8.4	<2	High-------	0.37			
30*:												
Garvin-----------	0-22	40-60	1.25-1.45	<0.06	0.12-0.18	6.6-8.4	<2	High-------	0.37	5	---	1-3
	22-75	35-60	1.35-1.65	<0.06	0.12-0.22	7.9-8.4	<2	High-------	0.37			
Elandco----------	0-34	18-27	1.30-1.50	0.6-2.0	0.15-0.22	6.6-8.4	<2	Moderate	0.43	5	6	1-3
	34-75	18-35	1.30-1.50	0.6-2.0	0.15-0.22	7.4-8.4	<2	Moderate	0.43			
31----------------- Gasil	0-7	8-20	1.50-1.60	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low--------	0.24	5	3	.5-1
	7-72	15-35	1.50-1.60	0.6-2.0	0.12-0.19	5.1-6.5	<2	Moderate	0.32			
32----------------- Gasil	0-4	8-20	1.50-1.60	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low--------	0.24	5	3	.5-1
	4-80	15-35	1.50-1.60	0.6-2.0	0.12-0.19	5.1-6.5	<2	Moderate	0.32			
33----------------- Gasil	0-16	8-20	1.50-1.60	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low--------	0.24	5	3	.5-1
	16-80	15-35	1.50-1.60	0.6-2.0	0.12-0.19	5.1-6.5	<2	Moderate	0.32			
34----------------- Gasil Variant	0-13	7-20	1.30-1.50	0.6-2.0	0.12-0.23	5.1-6.5	<2	Low--------	0.28	5	---	1-4
	13-40	18-35	1.40-1.70	0.6-2.0	0.05-0.16	4.5-5.5	<2	Moderate	0.10			
	40-75	18-35	1.40-1.70	0.6-2.0	0.13-0.24	4.5-5.5	<2	Moderate	0.28			
35----------------- Grainola	0-8	27-35	1.30-1.60	0.2-0.6	0.08-0.20	7.4-8.4	<2	Moderate	0.37	3	---	.5-1
	8-28	35-60	1.35-1.65	0.06-0.2	0.10-0.20	7.9-8.4	<2	High-------	0.37			
	28-60	---	---	---	---	---	---	-----------	-----			
36*: Kingfisher Variant---------	0-12	15-26	1.30-1.50	0.6-2.0	0.16-0.24	5.6-6.5	<2	Low--------	0.37	2	---	1-3
	12-16	18-35	1.45-1.70	0.6-2.0	0.16-0.24	5.6-6.5	<2	Low--------	0.37			
	16-35	27-35	1.45-1.70	0.6-2.0	0.18-0.22	6.1-7.3	<2	Moderate	0.32			
	35-40	---	---	---	---	---	---	-----------	-----			
Rock outcrop.												
37*: Kiti-------------	0-14	20-27	1.45-1.70	0.6-2.0	0.05-0.17	6.6-8.4	<2	Moderate	0.28	1	---	1-3
	14-16	---	---	---	---	---	---	-----------	-----			
Rock outcrop.												
38*: Kiti-------------	0-12	20-27	1.45-1.70	0.6-2.0	0.05-0.17	6.6-8.4	<2	Moderate	0.28	1	---	1-3
	12-15	---	---	---	---	---	---	-----------	-----			
Rock outcrop.												
39*: Kiti-------------	0-15	27-35	1.30-1.60	0.6-2.0	0.05-0.15	6.6-8.4	<2	Moderate	0.20	1	---	1-3
	15-20	---	---	---	---	---	---	-----------	-----			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH	Mmhos/cm					Pct
39*:												
Scullin----------	0-7	27-35	1.30-1.60	0.6-2.0	0.13-0.19	5.6-6.5	<2	Moderate	0.32	2	---	1-3
	7-12	25-40	1.40-1.70	0.6-2.0	0.10-0.23	5.6-6.5	<2	Moderate	0.32			
	12-34	35-60	1.35-1.65	0.2-0.6	0.06-0.19	5.6-8.4	<2.	High------	0.28			
	34-40	---	---	---	---	---	---	----------	----			
40---------------- Konawa	0-16	10-18	1.30-1.60	2.0-6.0	0.11-0.15	5.1-6.5	<2	Low--------	0.24	5	3	.5-1
	16-64	18-30	1.50-1.70	0.6-2.0	0.12-0.16	5.1-6.0	<2	Low--------	0.32			
	64-78	10-24	1.50-1.70	2.0-6.0	0.11-0.15	5.1-7.3	<2	Low--------	0.24			
41---------------- Konsil	0-10	8-20	1.30-1.60	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low--------	0.24	5	3	<1
	10-72	18-33	1.50-1.70	0.6-2.0	0.12-0.19	5.1-6.5	<2	Moderate	0.32			
42---------------- Lula	0-12	15-27	1.30-1.55	0.6-2.0	0.16-0.20	5.6-6.5	<2	Low--------	0.37	3	---	1-3
	12-18	18-35	1.45-1.70	0.6-2.0	0.16-0.20	5.6-6.5	<2	Moderate	0.37			
	18-58	27-35	1.45-1.70	0.6-2.0	0.16-0.20	5.1-7.3	<2	Moderate	0.32			
	58-60	---	---	---	---	---	---	----------	----			
43---------------- McLain	0-24	27-35	1.30-1.60	0.2-0.6	0.15-0.22	6.1-8.4	<2	Moderate	0.37	5	---	1-3
	24-60	35-50	1.45-1.70	0.06-0.2	0.12-0.22	6.1-8.4	<2	High------	0.37			
	60-75	20-45	1.40-1.70	0.06-0.6	0.12-0.24	6.6-8.4	<2	High------	0.43			
44---------------- Norge Variant	0-12	15-26	1.30-1.50	0.6-2.0	0.16-0.24	5.6-7.3	<2	Low--------	0.43	5	---	1-3
	12-21	18-35	1.40-1.70	0.6-2.0	0.15-0.24	5.6-7.3	<2	Moderate	0.43			
	21-55	27-35	1.40-1.70	0.6-2.0	0.15-0.22	5.6-7.3	<2	Moderate	0.37			
	55-75	30-45	1.40-1.70	0.06-0.2	0.12-0.22	5.6-7.3	<2	High------	0.37			
	75-80	---	---	---	---	---	---	----------	----			
45*. Pits												
46---------------- Rayford	0-11	18-26	1.30-1.55	0.6-2.0	0.10-0.15	7.9-8.4	<2	Low--------	0.28	1	---	1-3
	11-16	18-35	1.40-1.70	0.6-2.0	0.07-0.12	7.9-8.4	<2	Moderate	0.24			
	16-18	---	---	---	---	---	---	----------	----			
47*:												
Rayford----------	0-8	18-26	1.30-1.55	0.6-2.0	0.10-0.15	7.9-8.4	<2	Low--------	0.28	1	---	1-3
	8-14	18-35	1.40-1.70	0.6-2.0	0.07-0.12	7.9-8.4	<2	Moderate	0.24			
	14-18	---	---	---	---	---	---	----------	----			
Urban land.												
48---------------- Renfrow	0-10	18-27	1.30-1.55	0.6-2.0	0.15-0.24	6.1-7.8	<2	Low--------	0.49	4	6	1-3
	10-16	32-40	1.45-1.70	0.2-0.6	0.15-0.20	6.1-7.8	<2	Moderate	0.43			
	16-62	35-55	1.40-1.70	<0.06	0.12-0.18	6.1-8.4	<2	High------	0.43			
49---------------- Renfrow	0-9	18-27	1.30-1.55	0.6-2.0	0.15-0.24	6.1-7.8	<2	Low--------	0.49	4	6	1-3
	9-15	32-40	1.45-1.70	0.2-0.6	0.15-0.20	6.1-7.8	<2	Moderate	0.43			
	15-58	35-55	1.40-1.70	<0.06	0.12-0.18	6.1-8.4	<2	High------	0.43			
50*: Rock outcrop.												
Kiti--------------	0-12	20-27	1.45-1.70	0.6-2.0	0.05-0.17	6.6-8.4	<2	Moderate	0.28	1	---	1-3
	12-15	---	---	---	---	---	---	----------	0.24			
51*:												
Shidler----------	0-10	27-35	1.30-1.60	0.6-2.0	0.18-0.22	6.1-8.4	<2	Moderate	0.32	1	---	1-5
	10-14	---	---	---	---	---	---	----------	----			
Clarita----------	0-14	40-60	1.25-1.55	<0.06	0.12-0.20	6.1-8.4	<2	High------	0.37	4	---	1-3
	14-60	40-60	1.40-1.70	<0.06	0.12-0.18	7.9-8.4	<2	High------	0.37			
52*:												
Shidler----------	0-8	27-35	1.30-1.60	0.6-2.0	0.18-0.22	6.1-8.4	<2	Moderate	0.32	1	---	1-5
	8-10	---	---	---	---	---	---	----------	----			
Rock outcrop.												

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	G/cm^3	In/hr	In/in	pH	Mmhos/cm					Pct
53---------------- Stephenville Variant	0-14	10-18	1.30-1.60	2.0-6.0	0.11-0.15	5.6-6.5	<2	Low--------	0.24	2	---	<1
	14-36	18-35	1.50-1.70	0.6-2.0	0.11-0.17	5.1-6.5	<2	Low--------	0.32			
	36-40	---	---	---	---	---	---	-----------	----			
54*:												
Stephenville Variant---------	0-14	10-18	1.30-1.60	2.0-6.0	0.11-0.15	5.6-6.5	<2	Low--------	0.24	2	---	<1
	14-32	18-35	1.50-1.70	0.6-2.0	0.11-0.17	5.1-6.5	<2	Low--------	0.32			
	32-35	---	---	---	---	---	---	-----------	----			
Darnell Variant-	0-14	10-18	1.30-1.60	2.0-6.0	0.11-0.15	5.1-6.5	<2	Low--------	0.20	1	---	<1
	14-20	---	---	---	---	---	---	-----------	----			
55---------------- Teller	0-22	10-20	1.30-1.55	2.0-6.0	0.12-0.16	5.6-6.5	<2	Low--------	0.37	5	---	1-3
	22-56	18-30	1.45-1.70	0.6-2.0	0.14-0.18	5.6-6.5	<2	Low--------	0.32			
	56-72	10-20	1.30-1.60	2.0-6.0	0.13-0.17	5.6-7.3	<2	Low--------	0.32			
56---------------- Teller	0-22	10-20	1.30-1.55	2.0-6.0	0.12-0.16	5.6-6.5	<2	Low--------	0.37	5	---	1-3
	22-55	18-30	1.45-1.70	0.6-2.0	0.14-0.18	5.6-6.5	<2	Low--------	0.32			
	55-75	10-20	1.30-1.60	2.0-6.0	0.13-0.17	5.6-7.3	<2	Low--------	0.32			
57---------------- Timhill	0-7	10-25	1.30-1.55	0.6-2.0	0.09-0.17	5.6-7.3	<2	Low--------	0.15	1	---	1-4
	7-15	10-25	1.40-1.65	0.6-2.0	0.09-0.16	5.6-7.3	<2	Low--------	0.10			
	15-18	10-25	1.40-1.65	2.0-6.0	0.04-0.08	6.1-6.5	<2	Low--------	0.10			
	18-30	---	---	---	---	---	---	-----------	----			
58*:												
Travertine-------	0-13	10-18	1.30-1.50	0.6-2.0	0.10-0.19	5.6-6.5	<2	Low--------	0.24	1	---	1-4
	13-18	10-18	1.40-1.65	0.6-2.0	0.06-0.12	5.6-7.3	<2	Low--------	0.10			
	18-26	---	---	---	---	---	---	-----------	----			
Bromide----------	0-18	10-18	1.30-1.50	0.6-2.0	0.10-0.20	5.1-6.5	<2	Low--------	0.20	2	---	1-4
	18-32	24-35	1.40-1.70	0.6-2.0	0.04-0.12	5.1-6.5	<2	Low--------	0.10			
	32-36	10-18	1.40-1.65	0.6-2.0	0.03-0.07	5.1-6.5	<2	Low--------	0.10			
	36-40	---	---	---	---	---	---	-----------	----			
59---------------- Tussy	0-6	40-50	1.25-1.45	<0.06	0.10-0.18	7.4-8.4	<2	High-------	0.37	3	---	.5-3
	6-28	40-60	1.35-1.60	<0.06	0.10-0.18	7.9-8.4	<2	High-------	0.37			
	28-60	35-50	1.35-1.70	<0.06	0.07-0.15	7.9-8.4	<2	High-------	0.37			
60---------------- Tussy	0-8	40-50	1.25-1.45	<0.06	0.10-0.18	7.4-8.4	<2	High-------	0.37	3	---	.5-3
	8-26	40-60	1.35-1.60	<0.06	0.10-0.18	7.9-8.4	<2	High-------	0.37			
	26-60	35-50	1.35-1.70	<0.06	0.07-0.15	7.9-8.4	<2	High-------	0.37			
61---------------- Watonga	0-20	40-60	1.25-1.45	<0.06	0.12-0.18	6.6-8.4	<2	High-------	0.37	5	---	1-3
	20-75	35-60	1.35-1.70	<0.06	0.12-0.20	7.4-8.4	<2	High-------	0.37			
62---------------- Watonga	0-18	35-40	1.30-1.60	0.06-0.2	0.15-0.20	6.6-8.4	<2	Moderate	0.43	5	---	1-3
	18-75	35-60	1.35-1.70	<0.06	0.12-0.20	7.4-8.4	<2	High-------	0.37			
63---------------- Wilson	0-8	18-27	1.40-1.65	0.2-0.6	0.15-0.20	5.6-7.3	<2	Low--------	0.43	5	---	.5-2
	8-44	35-50	1.50-1.70	<0.06	0.14-0.20	5.6-8.4	<2	High-------	0.37			
	44-80	35-60	1.50-1.70	<0.06	0.12-0.15	6.6-8.4	<2	High-------	0.37			
64---------------- Yahola	0-18	10-18	1.30-1.60	2.0-6.0	0.11-0.15	7.4-8.4	<2	Low--------	0.20	5	3	.5-1
	18-72	5-18	1.40-1.70	2.0-6.0	0.11-0.20	7.9-8.4	<2	Low--------	0.20			
65---------------- Yahola	0-18	5-10	1.30-1.60	6.0-20.0	0.07-0.11	7.4-8.4	<2	Low--------	0.17	5	2	.5-1
	18-70	5-18	1.40-1.70	2.0-6.0	0.11-0.20	7.9-8.4	<2	Low--------	0.20			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," and "perched" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Map symbol and soil name	Hydro-logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In			
1, 2, 3----------- Bastrop	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
4*:											
Bastrop----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
Urban land.											
5*:											
Bastrop----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
Konawa-----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
6---------------- Burleson	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
7*:											
Catoosa----------	B	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate.
Shidler----------	D	None--------	---	---	>6.0	---	---	4-20	Hard	Moderate	Low.
8, 9------------- Chigley	C	None--------	---	---	3.0-4.0	Perched	Feb-May	>60	---	High-----	Moderate.
10*:											
Chigley----------	C	None--------	---	---	3.0-4.0	Perched	Feb-May	>60	---	High-----	Moderate.
Naru-------------	C	None--------	---	---	>6.0	---	---	55-65	Hard	Moderate	Low.
11*:											
Chigley----------	C	None--------	---	---	3.0-4.0	Perched	Feb-May	>60	---	High-----	Moderate.
Urban land.											
12*:											
Chigley----------	C	None--------	---	---	3.0-4.0	Perched	Feb-May	>60	---	High-----	Moderate.
Clarita----------	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
13*:											
Claremore--------	D	None--------	---	---	>6.0	---	---	10-20	Hard	Moderate	Moderate.
Rock outcrop.											
14*:											
Claremore--------	D	None--------	---	---	>6.0	---	---	10-20	Hard	Moderate	Moderate.
Urban land.											
15, 16----------- Clarita	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
17*:											
Clarita----------	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
Urban land.											
18--------------- Dale	B	Rare--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
19, 20, 21, 22---- Durant	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Map symbol and soil name	Hydro-logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In			
23*:											
Durant-----------	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate.
Urban land.											
24---------------- Elandco	B	Occasional	Brief-----	Mar-Oct	>6.0	---	---	>60	---	Moderate	Low.
25---------------- Eufaula	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate.
26, 27, 28-------- Fitzhugh	B	None--------	---	---	>6.0	---	---	40-60	Soft	Moderate	Moderate.
29---------------- Garvin	D	Occasional	Very brief to brief.	Mar-Oct	>6.0	---	---	>60	---	High-----	Low.
30*:											
Garvin-----------	D	Frequent----	Very brief to brief.	Mar-Oct	>6.0	---	---	>60	---	High-----	Low.
Elandco----------	B	Frequent----	Brief-----	Mar-Oct	>6.0	---	---	>60	---	Moderate	Low.
31, 32, 33-------- Gasil	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate.
34---------------- Gasil Variant	B	None--------	---	---	>6.0	---	---	>60	---	Low------	High.
35---------------- Grainola	D	None--------	---	---	>6.0	---	---	20-40	Soft	High-----	Low.
36*:											
Kingfisher Variant---------	B	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate.
Rock outcrop.											
37*, 38*:											
Kiti-------------	D	None--------	---	---	>6.0	---	---	4-20	Hard	Moderate	Low.
Rock outcrop.											
39*:											
Kiti-------------	D	None--------	---	---	>6.0	---	---	4-20	Hard	Moderate	Low.
Scullin----------	C	None--------	---	---	>6.0	---	---	20-40	Hard	High-----	Moderate.
40---------------- Konawa	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
41---------------- Konsil	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate.
42---------------- Lula	B	None--------	---	---	>6.0	---	---	40-60	Hard	Moderate	Moderate.
43---------------- McLain	C	Rare--------	---	---	>6.0	---	---	>60	---	High-----	Low.
44---------------- Norge Variant	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
45*. Pits											
46---------------- Rayford	C	None--------	---	---	>6.0	---	---	8-20	Hard	Moderate	Low.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Map symbol and soil name	Hydro-logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In			
47*:											
Rayford----------	C	None--------	---	---	>6.0	---	---	8-20	Hard	Moderate	Low.
Urban land.											
48, 49------------ Renfrow	D	None--------	---	---	>6.0	---	---	>60	---	High------	Low.
50*:											
Rock outcrop.											
Kiti-------------	D	None--------	---	---	>6.0	---	---	4-20	Hard	Moderate	Low.
51*:											
Shidler----------	D	None--------	---	---	>6.0	---	---	4-20	Hard	Moderate	Low.
Clarita----------	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
52*:											
Shidler----------	D	None--------	---	---	>6.0	---	---	4-20	Hard	Moderate	Low.
Rock outcrop.											
53---------------- Stephenville Variant	B	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate.
54*:											
Stephenville Variant---------	B	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate.
Darnell Variant--	C	None--------	---	---	>6.0	---	---	10-20	Hard	Low------	Moderate.
55, 56------------ Teller	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate.
57---------------- Timhill	D	None--------	---	---	>6.0	---	---	10-20	Hard	Low------	Moderate.
58*:											
Travertine-------	C	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	Moderate.
Bromide----------	B	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	Moderate.
59, 60------------ Tussy	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
61, 62------------ Watonga	D	Rare--------	---	---	>6.0	---	---	>60	---	High-----	Low.
63---------------- Wilson	D	None--------	---	---	0-1.0	Perched	Nov-Mar	>60	---	High-----	High.
64---------------- Yahola	B	Occasional	Very brief	Mar-Oct	>6.0	---	---	>60	---	Low------	Low.
65---------------- Yahola	B	Frequent----	Very brief	Mar-Oct	>6.0	---	---	>60	---	Low------	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--PHYSICAL ANALYSES OF SELECTED SOILS

Soil series and sample number	Depth	Horizon	Particle-size distribution							
			Very coarse sand (2.0-1.0 mm)	Coarse sand (1.0-0.5 mm)	Medium sand (0.5-0.25 mm)	Fine sand (0.25-0.10 mm)	Very fine sand (0.10-0.05 mm)	Total sand (2.0-0.05 mm)	Silt (0.05-0.002 mm)	Clay (<0.002 mm)
	In		Pct	Pct	Pct	Pct	Pct	Pct	Pct	Pct
Bastrop[1] (77-OK-099-1)	0-8	Ap	0.6	1.2	2.0	3.5	16.4	23.7	66.2	10.1
	8-34	B21t	0.4	0.7	1.2	2.1	12.1	16.5	53.4	30.1
	34-63	B22t	0.6	0.8	1.3	2.0	9.5	14.2	55.7	30.1
	63-79	B3	0.9	0.7	0.9	1.5	12.2	16.2	55.9	27.9
Bromide[2] (78-OK-99-5)	0-4	A1	10.2	5.0	2.7	3.4	3.7	25.0	62.5	12.5
	4-18	A2	6.2	3.5	2.0	3.1	8.7	23.5	59.5	17.0
	18-32	B2	1.5	0.6	0.5	0.9	1.2	4.7	65.9	29.4
Chigley[3] (68-OK-99-1)	0-5	A1	---	---	---	---	---	66	16	18
	5-16	A2	---	---	---	---	---	62	22	16
	16-40	B2t	---	---	---	---	---	48	13	39
	40-52	B3	---	---	---	---	---	48	15	37
	52-64	C	---	---	---	---	---	59	7	34
Clarita[4] (77-OK-99-2)	0-6	A1	0.7	1.3	1.7	4.5	3.5	11.7	45.2	43.1
	6-20	AC	0.7	1.1	1.5	3.2	2.5	9.0	45.3	45.7
	20-33	C1	0.8	1.1	1.3	2.8	2.0	8.0	48.0	44.0
	33-66	C2	1.0	1.3	1.7	5.9	1.4	11.3	44.2	44.5
Dale[5] (77-OK-99-30)	0-6	Ap	0.1	0.1	0.1	0.4	6.3	7.0	64.2	28.8
	6-22	A1	0.1	0.1	0.1	0.4	8.4	9.1	59.6	31.3
	22-38	B2	0.1	0.1	0.1	0.4	9.2	9.9	48.8	41.3
	38-74	C	0.1	0.1	0.1	0.2	10.3	10.8	74.8	14.4
Gasil Variant[6] (78-OK-99-4)	0-3	A1	3.9	3.2	2.4	6.8	10.6	26.9	62.7	10.4
	3-13	A2	6.8	3.8	5.1	6.9	14.1	36.7	56.2	7.1
	13-26	B21t	0.9	0.5	2.4	0.9	2.6	7.3	62.1	30.6
	26-40	B22t	5.7	2.3	1.5	1.9	4.1	15.5	69.2	15.3
	40-65	B23t	1.2	0.7	0.7	1.4	5.8	9.8	62.8	27.4
Timhill[7] (77-OK-99-5)	0-7	A1	6.3	4.3	4.1	2.8	5.0	22.5	59.7	17.8
	7-15	B2	9.1	4.8	4.1	9.8	4.9	32.7	50.6	16.7
Travertine[8] (78-OK-99-6)	0-13	A1	7.9	5.7	3.2	4.4	6.2	27.4	60.4	12.2
	13-18	B2	9.4	4.9	3.6	5.2	11.8	34.9	48.9	16.2
Watonga[9] (77-OK-99-4)	0-7	Ap	0.1	0.2	0.2	0.4	0.6	1.5	40.3	58.2
	7-14	A1	0.1	0.2	0.3	0.5	0.7	1.8	38.1	60.1
	14-34	AC1	0.2	0.4	0.4	0.5	0.7	2.2	38.6	59.2
	34-58	AC2	0.6	0.8	0.5	0.5	0.8	3.2	38.0	58.8
	58-75	C	0.6	0.8	0.7	0.7	0.8	3.6	37.4	59.0

[1] Bastrop fine sandy loam: 2,500 feet east and 50 feet south of the northwest corner of sec. 25, T. 2 N., R. 1 E. This pedon is a taxadjunct to the Bastrop series because the B2t horizon is silty clay loam and the textural family is fine-silty. The percentage passing the 200 sieve is more than allowed for the series.

[2] Bromide channery silt loam: Typical pedon for the series.

[3] Chigley gravelly sandy loam: 2,000 feet west and 114 feet south of the northeast corner of sec. 27, T. 2 N., R. 3 E. This pedon is a taxadjunct to the Chigley series because the B2t horizon has a base saturation of 58 percent.

[4] Clarita clay: 2,000 feet south and 2,750 feet east of the northwest corner of sec. 16, T. 1 N., R. 2 E. This pedon is a taxadjunct to the Clarita series because the A horizon has chroma of 2 within a depth of 12 inches.

[5] Dale silt loam: 3,350 feet west and 50 feet south of the northeast corner of sec. 34, T. 2 N., R. 1 E. This pedon is a taxadjunct to the Dale series. The B2 horizon is slightly more clayey and the liquid limit and plasticity index are higher than allowed for the series.

[6] Gasil Variant shaly silt loam: Typical pedon for the Gasil Variant.

[7] Timhill stony silt loam: Typical pedon for the series.

[8] Travertine channery silt loam: Typical pedon for the series.

[9] Watonga clay: 1,900 feet east and 200 feet south of the northwest corner of sec. 1, T. 1 N., R. 1 E. This pedon is a taxadjunct to the Watonga series. The AC horizon has a higher exchangeable sodium percentage, liquid limit, and plasticity index than allowed for the Watonga series.

TABLE 19.--CHEMICAL ANALYSES OF SELECTED SOILS

Soil series and sample number	Depth	Horizon	Extractable bases (milliequivalents per 100 grams of soil)				Cation exchange capacity	Base saturation	Reaction 1:1 soil:water	Organic matter	Total phosphorus
			Ca	Mg	K	Na					
	In							Pct	pH	Pct	P/m
Bastrop[1/] (77-OK-099-1)	0-8	Ap	5.06	1.43	0.55	0.25	10.00	80.3	6.7	1.92	---
	8-34	B21t	4.69	4.65	0.35	0.30	18.80	59.7	5.2	0.73	---
	34-63	B22t	6.90	4.23	0.35	0.38	21.40	71.0	5.7	0.59	---
	63-79	B3	7.31	5.66	0.44	0.48	20.10	79.5	6.2	0.38	---
Bromide[2/] (78-OK-99-5)	0-4	A1	14.52	4.54	0.61	0.14	19.0	94.1	6.4	4.27	---
	4-18	A2	3.72	1.60	0.29	0.17	8.9	67.8	5.6	0.64	---
	18-32	B2	10.67	4.02	0.48	0.18	20.0	70.0	5.5	0.55	---
Chigley[3/] (68-OK-99-1)	0-5	A1	9.10	1.39	0.25	0.04	12.82	83.7	6.4	3.75	---
	5-16	A2	2.90	1.24	0.15	0.04	5.27	97.7	5.7	0.79	---
	16-40	B2t	7.00	2.99	0.35	0.09	17.61	42.5	5.0	0.71	---
	40-52	B3	6.30	4.07	0.26	0.11	13.91	45.4	5.3	0.65	---
	52-64	C	7.30	4.07	0.30	0.12	18.05	46.2	5.4	0.54	---
Clarita[4/] (77-OK-99-2)	0-6	A1	55.66	4.37	0.38	0.17	56.60	94.1	7.5	3.00	---
	6-20	AC	59.80	6.90	0.24	0.17	56.60	97.4	8.0	1.71	---
	20-33	C1	59.57	8.97	0.29	0.21	55.50	98.5	8.0	1.00	---
	33-66	C2	60.26	9.43	0.13	0.54	55.50	98.9	8.2	0.35	---
Dale[5/] (77-OK-99-30)	0-6	Ap	11.36	6.58	0.68	0.17	23.6	75.8	6.8	3.02	---
	6-22	A1	14.40	8.23	0.50	0.16	27.8	83.5	6.8	2.65	---
	22-38	B2	11.45	7.27	0.42	0.16	22.9	87.3	7.5	1.11	---
	38-74	C	39.56	7.41	0.22	0.16	13.4	100.0	8.2	0.62	---
Gasil Variant[6/] (78-OK-99-4)	0-3	A1	7.56	3.15	0.74	0.96	16.90	84.7	6.2	4.29	---
	3-13	A2	1.69	0.91	0.38	0.26	8.00	48.5	5.5	1.27	---
	13-26	B21t	2.03	3.28	0.43	1.35	16.40	38.7	4.3	0.77	---
	26-40	B22t	4.32	4.10	0.55	1.17	22.30	41.7	5.3	0.38	---
	40-65	B23t	7.95	6.87	0.55	1.04	23.50	59.4	5.0	0.29	---
Timhill[7/] (77-OK-99-5)	0-7	A1	15.00	2.99	0.55	0.27	24.90	81.3	6.9	4.17	---
	7-15	B2	8.46	2.76	0.28	0.32	15.50	79.4	6.9	1.91	---
Travertine[8/] (78-OK-99-6)	0-13	A1	13.31	1.60	0.64	0.17	18.80	78.4	6.5	3.42	---
	13-18	B2	5.96	2.59	0.27	0.15	7.70	79.8	6.6	0.77	---
Watonga[9/] (77-OK-99-4)	0-7	Ap	36.57	11.27	0.93	1.10	63.90	87.1	6.8	2.92	---
	7-14	A1	32.66	16.56	0.65	5.85	66.50	91.0	7.4	2.13	---
	14-34	AC1	36.80	20.93	0.59	11.33	63.20	95.5	7.9	1.88	---
	34-58	AC2	64.86	23.69	0.58	15.71	58.80	97.6	7.7	1.36	---
	58-75	C	39.56	21.85	0.63	12.24	50.40	98.1	8.0	0.78	---

See footnotes on facing page.

TABLE 20.--ENGINEERING INDEX TEST DATA

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution						LL	PI	Shrinkage		
			Percentage passing sieve--				Percentage smaller than--						
	AASHTO	Unified	No. 4	No. 10	No. 40	No. 200	.005 mm	.002 mm	**	**	Limit	Linear	Ratio
									Pct	Pct	Pct	Pct	Pct
Bastrop[1] (77-OK-099-1)													
B21t----------8-34	A-6(16)	CL	100	100	99	94	34	29	35	17	12	27	1.90
Clarita[2] (77-OK-99-2)													
AC------------6-20	A-7-6(32)	CH	100	100	96	90	52	41	58	32	6	78	2.15
Dale[3] (77-OK-99-30)													
A1------------6-22	A-6(19)	CL	100	100	100	97	37	31	39	18	12	34	1.90
B2-----------22-38	A-6(11)	CL	100	100	100	93	28	23	31	13	15	19	1.81
Watonga[4] (77-OK-99-4)													
AC1----------14-34	A-7-6(54)	CH	100	100	99	97	68	62	76	47	6	98	2.12
AC2----------34-58	A-7-5(68)	CH	100	100	98	96	79	78	91	59	12	107	2.17
C------------58-75	A-7-6(52)	CH	100	100	98	96	66	63	72	46	8	86	2.10

[1]Bastrop fine sandy loam: 2,500 feet east and 50 feet south of the northwest corner of sec. 25, T. 2 N., R. 1 E. This pedon is a taxadjunct to the Bastrop series. The B2t horizon is silty clay loam and the textural family is fine-silty. The percentage passing the 200 sieve is more than is allowed for the series.

[2]Clarita clay: 2,000 feet south and 2,750 feet east of the northwest corner of sec. 16, T. 1 N., R. 2 E. This pedon is a taxadjunct to the Clarita series because the A horizon has chroma of 2 within a depth of 12 inches.

[3]Dale silt loam: 3,300 feet west and 50 feet south of the northeast corner of sec. 34, T. 2 N., R. 1 E. This pedon is a taxadjunct to the Dale series. The B2 horizon is slightly more clayey and the liquid limit and plasticity index are higher than is allowed for the Dale series.

[4]Watonga clay: 1,900 feet east and 200 feet south of the northwest corner of sec. 1, T. 1 N., R. 1 E. This pedon is a taxadjunct to the Watonga series. The AC horizon has a higher exchangeable sodium percentage, liquid limit, and plasticity index than is allowed for the Watonga series.

TABLE 21.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Bastrop	Fine-loamy, mixed, thermic Udic Paleustalfs
Bromide	Loamy-skeletal, siliceous, thermic Ultic Haplustalfs
Burleson	Fine, montmorillonitic, thermic Udic Pellusterts
*Catoosa	Fine-silty, mixed, thermic Typic Argiudolls
Chigley	Fine, mixed, thermic Udic Paleustalfs
*Claremore	Loamy, mixed, thermic Lithic Argiudolls
*Clarita	Fine, montmorillonitic, thermic Udic Pellusterts
Dale	Fine-silty, mixed, thermic Pachic Haplustolls
Darnell Variant	Loamy, siliceous, thermic Lithic Ustochrepts
Durant	Fine, montmorillonitic, thermic Vertic Argiustolls
Elandco	Fine-silty, mixed, thermic Cumulic Haplustolls
Eufaula	Sandy, siliceous, thermic Psammentic Paleustalfs
*Fitzhugh	Fine-loamy, mixed, thermic Typic Argiudolls
Garvin	Fine, mixed, thermic Vertic Haplustolls
Gasil	Fine-loamy, siliceous, thermic Ultic Paleustalfs
Gasil Variant	Loamy-skeletal, siliceous, thermic Ultic Paleustalfs
Grainola	Fine, mixed, thermic Vertic Haplustalfs
Kingfisher Variant	Fine-silty, mixed, thermic Udic Argiustolls
Kiti	Loamy-skeletal, mixed, thermic Lithic Haplustolls
*Konawa	Fine-loamy, mixed, thermic Ultic Haplustalfs
Konsil	Fine-loamy, siliceous, thermic Ultic Paleustalfs
*Lula	Fine-silty, mixed, thermic Typic Argiudolls
McLain	Fine, mixed, thermic Pachic Argiustolls
Naru	Loamy-skeletal, mixed, thermic Udic Haplustalfs
Norge Variant	Fine-silty, mixed, thermic Udic Paleustolls
Rayford	Loamy-skeletal, mixed, thermic Lithic Haplustolls
Renfrow	Fine, mixed, thermic Udertic Paleustolls
Scullin	Fine, mixed, thermic Udic Argiustolls
Shidler	Loamy, mixed, thermic Lithic Haplustolls
Stephenville Variant	Fine-loamy, siliceous, thermic Ultic Haplustalfs
Teller	Fine-loamy, mixed, thermic Udic Argiustolls
Timhill	Loamy-skeletal, mixed, thermic Lithic Haplustolls
Travertine	Loamy-skeletal, siliceous, thermic, shallow Udic Ustochrepts
Tussy	Fine, montmorillonitic, thermic Vertic Ustochrepts
Watonga	Fine, montmorillonitic, thermic Udic Pellusterts
Wilson	Fine, montmorillonitic, thermic Vertic Ochraqualfs
Yahola	Coarse-loamy, mixed (calcareous), thermic Typic Ustifluvents

* The soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series.

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